
INTRODUCTION

The intent of the authors of this manual is to educate the person who can see, understand and represent the shape of the human body in its spatial, volumetric dimension and plastic. To be able to see form in space, one must learn to recognise the key points or ideals, unite them with a series of trajectories which they will identify from first elementary perimeter lines, then floors and surfaces, and then volumes plastid. Points, lines and planes allow to build an architecture of the body human "made of air", where the boundaries between interior and exterior and the volumes of the forms are identified by the section.

This section is one of the key concepts around which our manual revolves of artistic anatomy. The etymology of the section itself refers to anatomy (ανατομή. ~ in Greek means dissection). Anatomising, in our case, means dissecting figuratively, doe with the tools of drawing, an organism to purpose of exploring the structures that support it and determine its overall shape and final.

Another fundamental aspect of our work will be the study of relationships proportional between the individual parts of the human figure and between the parts and the whole, that it will be carried out with the aid of a modular division of the man structure. Through these two tools, the section and the module, we will conduct a series of surveys, analytical surveys and exercises that will allow one to deconstruct e reconstruct the figure of the human body as if it were an architectural structure. The verification of each point of the figure through this complex work will make it transparent, making us overcome the obtuseness and perceptive deception that characterise the first vision of the human body; we will learn how to read the form even on the side hidden from view, so it can be drawn "with the mind's eye".

There are four moments or levels in which the work is divided. The first level and dedicated to the visualisation in space of the figure, reduced to its most elementary terms, through the use of the point, the line and the plane. The second takes in consideration of

the different osteological segments with respect to the functions they are assigned to. They study their structure, shape and surface; the answers are analysed mechanical stresses (pressure, traction, torsion, sliding); is observed how they are tied, hinged, welded to other elements. At the third level they are analysed the plastid values of the body surface with respect to a quiet situation and the attention is focused on the myological relief and on how the synergistic contraction of a group of muscle bands, activated to produce movement, changes in the shape and volume of the affected region.

Finally, at the fourth level, we deal more specifically with the interaction between the human structure and the space it contains; their balances are studied, analysing the counterbalances of the volumes with respect to the axis, both in quiet conditions (station upright and symmetrical equilibria), and in dynamic condition (asymmetrical equilibrium).

You will have understood that the analyses and exercises we propose presuppose a concept drawing which is not only that of the representation for illustrative purposes of the reality, but also that for which the operations of observing and doing coincide Leonardo's conception of the eye as an instrument of phenomenological exploration of reality capable of questioning itself and giving answers on the "showing itself" of phenomena visible. And it should also be noted that the proposal to draw using tools such as the form must not be understood as absolutely binding: and, in fact, only instrumental, useful to fruitfully follow an itinerary, such as the one traced here, destined to stop on the threshold of free interpretation creative shape. To others, and to the same reader at a later time, and left The 'honour and the' burden of venturing into a phase of greater artistic creativity, too if he realises he is practicing it to some extent already within the path proposed by us.

In signing our work, we thank Luca Bendini, Giancarlo Venuto, Marilena Nardi, Juan Carlos Battiloni for the encouragement and valuable advice amicably provided in the design and implementation phase of the libra, while we are thankful to Gian Luigi Cazzola and Chiara Cocco who assisted us in the realization

some texts.

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MAN STRUCTURE

"A human body and an architecture of shapes that fit together and support each other one with the other, comparable to a building as a whole each different part has its role; if one of the elements is not in its place, everything collapses ".

H. Matisse

SEE THE ANATOMICAL SPACE OF MAN

Before starting our analysis of the structure and the shape of the human body, it is necessary to reiterate the method of investigation according to which ours will develop work: probing the anatomical forms through axes and planes which will then allow us to reveal them through the their sections ("anatomise" means to dissect). To better understand the morphological complexity of the object of our study it will be better to start from orientation spatial prince of the man-structure: the upright and symmetrical posture. It will be examined in its three dimensions of height, width and depth identified at once, precisely by the axes and planes as indicated in Figures A, B, C.

SPATIAL DIRECTIONS

Directions and points of view that will recur in studies and performances graphics (Fig. C).

S> Superior or cranial

I > Inferior or caudal

M > Mediale, direction closest to medial plane
L > Lateral, furthest direction to the medial plane
A > Anterior, ventral direction
P > Posterior, dorsal direction

For the limbs we have the following orientations (Fig. C).

Pr > Proximal, highest position, i.e. close to the root of the limb
D > Distal, lowest position, that is, distant from the root of the limb
Pa > Palmare, i.e. from the palm side of the hand
Do > Dorsal, ie from the side of the dorsum of mana or foot
Pl > Plantar, i.e. from the side of the sole of the foot

Further points of view

Superficial and profound correspond at the distance from surface of the external body and internal body generally refer to those anatomical districts that have hollow formations, such as chest, head and pelvis

Points of view in the relationship with three-dimensional space (Fig. C).

AL Antero-lateral, three-dimensional view of the antedate plan and of the lateral plane

PL Postero-lateral, three-dimensional view of the pastedare plan and lateral

Fig. A Orthogonal axes

M Medimw axis (longitudinal): identify the dimension in height
S Sagittnle axis (anterior-posterior): identify the size in depth
T transversal axis (horizontal); locate the size in width

Fig. B Orthogonal planes

PM Piano Medianle or Sagittale there from the perception of height in depth, dividing the space-man in two almost symmetrical halves (called sagittal by analogy with the homonymous one cranial suture)

PF Frontal Plane gives us perception of width in height

PT Transversal Plan gives us the perception of width in the depth.

Fig. C.

The orthogonal planes PM ~ {PF, PT, delimit it space on the level of perimeter trend It is also useful to consider other parallel planes such as the floor plan indicated with PP

THE SKELETAL STRUCTURE OF MAN

The skeleton is a self-supporting structure, held together by a complex system of tie rods, ligaments, membranes and tendons muscle. It consists of an axial part (trunk-head together) e on an appendicular part (together with the limbs). The skeleton is thus aligned on the main median axis which crosses it longitudinally and on the transverse axes corresponding to the shoulders and hips. What constructive device should be compared to a mechanism self-propelled architectural, able to withstand the forces that they burden or are exerted on it both in static conditions and in dynamic conditions.

Let's look at the bone elements that they form together the entire skeletal system, from a functional point of view. They can be compared to solids with flat surfaces, concave or convex, with corresponding angles or perimeter margins to specific construction functions.

In the morphological detail we can identify herninences and lisc cavities that coincide with the joints and protrusions or wrinkled depressions, such as tuberosities, thorns, notches, furrows and

were they correspond respectively to the connection points ligaments or muscle tendons.

As for the mechanical functionality, the bone structure is resistant and light especially in the limbs, to better support the body weight and facilitate movement in walking.

As for its composition, the bony element has a compact or cortical substance that covers like a "shell" an internal spongy substance, formed by the intertwining of many small beams or trabeculae between which interposed cavities and contents the bone marrow.

These micro-tie rods are oriented in crossed linear bands and intersected almost orthogonally: an arrangement that gives the skeletal element the solidity necessary for withstand the mechanical stresses of pressure forces and traction.

Based on the expansion and morphological development of the bones have various dimensions, according to which they can classify into long, flat, short and irregular bones.

Long bones

They are those of the limbs, where the dimension is measured on the axis longitudinal clearly prevails over the others. They consist of a diaphysis formed by a tubular body elongated cylindrical or prismatic containing a medullary canal central, and by two epiphyses or extremities dilated in forms articular.

Flat bones

They form part of the cranial vault, part of the trunk, of the pelvic girdle and shoulder girdle (see lessons 5 and 30). The dimensions of the length and width prevail over the thickness. They consist of two extended cortical amines, concave from inner side and convex from the outer side, which contain one more or less thick layer of cancellous tissue.

Short bones

They consist of a spongy nucleus and a surface relatively thin cortex on which superlids are placed articular. They are found mainly in the extremities of the limbs. They can take very different

forms: for example cuboidal, trapezoidal, cuneiform (see lesson 36).

Irregular bones

They correspond to atypical forms, which do not fit into the groups listed above: and the case, for example of the vertebrae. This classification is indicative only. We will study the bone elements not individually, but in the construction relationship global, based on the functions they are responsible for.

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- Longitudinal section of the exterior superior (proximal) of the femur.
 - Orientation of the trabeculae in lines of force.
 - Example of longitudinal section of a long bone, the humerus (right). Internal composition:

1 medullary canal
2 spongy substance
3 cortical or compact substance external

THE ARTICULAR DEVICES OF THE SKELETON

By skeletal joint we mean the fixed or mobile relationship of bony parts, held by a complex of tissue fibrous and cartilage which acts as support and reinforcement.

Excluding the morphological representation of the ligaments and other soft components, we will visualize the joints as mechanical devices, to better understand how The shape of the articular surface predisposes the principles of continuity of the parts of reciprocal mobility. The volumetric analysis it will then allow us to see which movements the articulation and able to transmit on the direction of the skeletal segments.

But let's see how the joints can be classified in based on shape and ability to promote various degrees of cohesion both fixed and mobile. The function of the joint can be defined by the concepts of continuities and contiguities.

Joints for continuity: Synarthrosis

They are characterised by flat or serrated edges and bone surfaces which allow a very close cohesion of the single ones set off. The connection is given by fibrous, cartilaginous joints or by direct welding of the elements. Synarthrosis, depending on the tissue interposed between the surfaces articular are distinguished in

1. Synchondrosis: there is a cartilage junction in the transitional phases growth such as, for example, the cartilaginous joints of the iliac bone those between ribs and sternum.
2. Sutures: correspond to the serrated and serrated edges of the flat bones of the crania that form a continuous union of the parts, held together from a layer of connective tissue, the suture membrane. See, for example, the sagittal suture (detail A), coronal, lambdoid and scaly, temporo-parietal (detail B).
3. Synostosis: when the actual fusion between the two bones takes place, as ad example in the bones of the crania for the partial dissolution of the lines of suture that occurs in old age.
4. Syndesmosis: when the bones are closely connected by interosseous ligaments which, with their elasticity, provide a low degree of renewal. Examples are the interosseous membranes of the garnba (detail C)
5. Symphysis: where there is the connection of two parallel facets by means of tissue fibrocartilaginous the thickness of which allows a limited degree of rehabilitation. An example is the pubic symphysis, the anterior joint between the two hip bones (detail D) (see lesson 5).

Joints by continuity and by contiguity: Amphiarthrosis

They are composed of irregular joint surfaces where it starts of the joint corresponds to a syndesmosis and the remainder to an arthrodia. By conformation of the articular surfaces e of very tense ligaments the degree of mobility is extremely reduced. In example, the sacroiliac joint between the surfaces auricles of the sacra and ileum (see lesson 5).

Joints by contiguity: Diarthrosis

They are based on the connection of flat bones and circular and on whose surfaces certain degrees are generated of joint mobility. In the link we find, in addition to the cordiform and ribbon-like ligaments, a fibrous capsule of lining, articular discs, membranes and synovial horse. These joints are mainly located in the limbs. The diarthrosis, depending on the joint shapes and movements transmitted in one or more directions are divided into types following:

1. Pinna joint or Arthrodia: it is a joint placed on two articular heads planes with slight degrees of curvature that pernnenti of the movements of contiguous slip (details A and B). Joints are examples of this intrinsic to the tarsus, carpus and small vertebral joints.
2. Trochlea or Angular Ginglimo joint: it is given by two articular heads (one convex and the other concave) arranged on the transverse direction, of a shape similar to the cylinder (detail C), with consequent groove and medial relief (details D-E). This type of articulation can convey on the longitudinal axis of the bone segments the flexion movements and extension (detail E, 1-2).
3. Trochoid or Lateral Ginglimo joint: it is constituted by a cylindrical head that slides within the annellar arch of a hollow surface. Can between stop a rotational movement on the longitudinal axis of the segment bone (detail F): for example the radio-ulnar joint in the extremity proximal and distal of the forearm.

4. Ellipsoidal Joint and Condylarthrosis: the two joint heads are direct on the transverse axis with concave and convex elliptical surfaces. These joints transmit two types of renewal: one on direction lateral (detail G, 1), the other on the antero-posterior direction (detail G, 2). Examples are the radio-carpal joint of the wrist (detail G) and the temporomandibular joint (detail H) (see lesson 26).

5. Saddle joint: corresponds to two ends whose articular surface is arranged on a double convex and concave curvature (detail P) as in the form of a saddle. Innovations are obtained in two directions. An example is the articulation of the trapezoid with the first metacarpal, which allows t and the biaxial movement of the thumb (detail F).

6. Spherical joint or Enarthrosis: formed by two joint heads, one axis milabile to a sphere (head) the other similar to a cup, able to count black called spheroidal body (detail J).

And the mobile pillar joint capable of transmitting the pill on the longitudinal axis of the skeleton extended and multiple movements such as: rotation, flexion, extension, abduction, adduction up to the circling (detail K6).

Long transmitted hip enarthrosis the axis of the femur in the movements of

- 1 adduction
- 2 abduction
- 3 flexion in adduction
- 4 internal rotation
- 5 flexion in abduction
- 6 circling

Flexion:

movement of two skeletal segments tending to on the transverse articular axis an angular always more acute, with the approach of the ventral surfaces. See for example the movement of the upper limb right.

Extension:

movement of two skeletal segments tending to arrange themselves on the same longitudinal plane, with the departure of two ventral surfaces: for example the movement of the limb upper right.

Abduction:

movement away from the midline: for example abduction of the limb lower right.

Adduction:

approach movement to the midline: for example the adduction of the lower limb right.

Rotation:

rotation of the segment skeletal around its own longitudinal axis. They stand out two types, towards the outside - external rotation - and towards the inside - internal rotation. See, as an example, the radio-ulnar joint of the left upper limb in supination movements and pronation.

Surrounding:

movement in which the bone segment circumscribes a conical space, with apex on articular head generator. It is given by the combination of the movements flexion, extension, abduction and adduction. And a typical movement of the joints humero-scapular and coxo-femoral, shoulder and hip respectively.

THE SKELETAL MUSCLES, THEIR SHAPE AND FUNCTIONS

The articular device identified in the structure of the skeleton and dynamically activated by the muscles thanks to which chemical energy is transformed into mechanical work.

Muscles are contractile organs, of variable shape and thickness, arranged in bundles, with fibres oriented on the traction line, that is, in the direction in which the muscle exercises its own power action.

By connecting to the skeleton, they contribute to the construction

of the man-structure, are able to fix the postures and maintaining balance. Furthermore they, in their variable alternation according to the different postures of the human figure, they give it a plastic relief that manifests itself on the edge skin and that we can study analytically through sections of the muscles themselves.

Muscles are made up of a body and two extremities. The body and the contractile portion made up of organized, arranged fibres parallel with convergence towards the ends. Yes it is a plastic mass with volumetric variability, capable of shortening and lengthening. Strength comes from the body of the muscle that is applied to the bones.

The extremities are formed by tendons; these are inextensible segments, similar to cords or damaged amines, which allow the insertion of the muscle to the skeleton. The two extreme points of the connection of the muscle with the skeleton is called origin and insertion. The origin is always at the most proximal point (towards the center of the body), the insertion and at the opposite extreme, that is in distal position.

SHAPE OF MUSCLES

The morphological characteristics of the muscles depend on the their arrangement on the skeleton and by the function of that muscle must exercise.

Skeletal muscles can be classified into two groups: long muscles and wide muscles.

Long muscles: they are generally located on the limbs, they are arranged longitudinally and provided, at the ends, with tendons.

Some examples relating to the shape and position of the tendon:

- A fusiform muscle
- B ribbon-like muscle
- C semipinnate muscle
- D bipinnate muscle

The semipennate muscle has the tendon located laterally; it is accompanied for a part of its course from the fibres of the muscle body.

The bipinnate muscle presents the tendon in the centre of the body; also in this case the muscle fibres are grafted along the its course.

Multiplex muscles have respect-oriented muscle fibres to the tendon, in various directions.

Wide muscles: they are mainly located on the trunk, have an extended muscular body (1), of variable thickness and broad, flattened tendons (2). Sometimes the tendons take over the appearance of very thin sheaths that take the name of aponeurosis; the tendon can also occur in the middle of the muscular body, dividing it transversely (G, 1-2; see rectus abdominis).

Muscles can have vaguely rectangular shapes (G, I), triangular (F, H), delta (J), trapezoidal (E).

Certain muscles originate with multiple strands, then merging into one only belly or muscular body that extends into a single one insertion tendon: biceps (L), triceps (M) and quadriceps (see lesson 11). These particularly powerful muscles can be located and express his own action in several points of the skeleton.

FUNCTIONAL PROPERTIES

Muscles can exercise their dynamic action vary their volume through the mechanism of contraction and relaxation.

Muscle contraction brings the two skeletal segments closer, as in the case of flexion (1).

The relaxation of the muscular body produces distancing of the skeletal segments, as in the case of extension (2).

The muscles that contract to bring about movement they are called synergists (S).

The muscles that relax allowing or restraining the action synergists are called antagonists (A).

Example 1

In the flexion movement the synergist muscle (S) shortens, its antagonist it stretches.

Example 2

In the extension movement, the roles are reversed: the antagonist muscle becomes synergist, the synergist becomes antagonist.

Example 3

In the graphic example the skeletal segment of the lower limb is represented left, to which the rectus femoris (anterior) muscles are connected the bicipid femoral (posterior), at the points of origin (or) and insertion (in).

Example 4

Anterior flexion of the left lower limb with respect to the trunk. The synergist brochure (S) contracts as it increases in volume. It exerts the power on the fixed tip (PF) of the pelvis that remains stationary; the skeletal segment is moved forward on moving tip (PM). Posteriorly the antagonist muscle (A) stretches, thus to allow the synergist muscle to express its action.

Example 5

Flexion of the left leg on the thigh. Exchange of roles. The posterior muscle becomes synergist (S), contracting on the line of traction that goes from the tip fixed (PF) to the moving point (PM). The anterior muscle becomes antagonist (A) and by lengthening it allows the synergistic action (S) of the posterior muscle.

Example 6

In this case, the muscles are connected to the skeletal segment of

the lower limb rectus femoris (anterior) and gluteus maximus (posterior).

Example 7

Further flexion of the pelvis. The synergist muscle (S) exerts power on the point fixed (PF) causing the anterior displacement of the pelvis on the mobile tip (PM). The antagonist muscle (A) stretches allowing the action of the muscle synergist (S).

Example 8

Extension of the lower limb. The posterior muscle assumes the role of synergist muscle (S); The contraction between PF and PM determines the extension. The anterior muscle having become antagonist (A) he stretches to allow movement.

In all the cases listed above if we had the contraction in equal measure of the synergists and antagonists we would obtain the fixation (blocking) of the skeletal segments.

Lesson 1

IDENTIFICATION OF THE MAN-STRUCTURE AND THE AXIS OF SYMMETRY

To undertake this journey within the representation graphics of the human figure and of fundamental importance to identify the proportional ratios that bind the individual parts of the human structure and the relationship of the parts themselves with the whole. It is therefore necessary to establish a modular distribution of the form human, which we perform by adopting a can one in 8/8, in which the height of the head reported eight times on the axis of the figure determines it I 'overall height.

The module of the head as $\frac{1}{8}$ of the height of the entire human body and already in Durer - which he referred to the proportions of Vitruvius - who, as it is already a practice of Durer to resort to the figures geometric shapes of the square and rectangle to schematize in simple way but effective the individual parts of the human figure. Such canon will inspire Schlenuner's studie¹

The module we use (corresponding to the height of the head measured from the top of the skull to the menlo) can be further divided, in such a way as to allow identification of parts of the figure smaller or larger than the module itself. We will therefore have submodules, that is, portions of module and of the over modules, i.e. the module plus a fraction of it.

The whole human figure in its overall volume can be inscribed in a ratio of eight modules of height for two modules in width, while for the depth dimension we will have to identify the foot over module that corresponds to 1 module + $\frac{1}{6}$ of module.

To correctly construct the prismatic figure identified by the eight

modules (table I, figs. A-G) we must intersect the projection the perimeter of the figure in its anterior view (frontal plane) with the projection of the perimeter in the lateral view (plane sagittal), superimposing the axes of the two figures (as in fig. B). The frontal plane intersects the sagittal plane orthogonally, so called by analogy with the homonymous cranial suture that the plane it identifies, or more simply the median plane, because it divides la shape in two symmetrical parts. This three-dimensional scaffolding reference and completed by the horizontal planes, also called transverse planes, which cross the body orthogonally with respect to the frontal and median planes.

¹ See Wittkover, Architectural principles in the etii of Humanism, Turin, Einaudi, 1964, pp. 18-22, note 5; E. Panofsky, Il Meaning in the Visual Arts, Turin, Enaudi, 1962, pp. 61-106; Albrecht Diirer, The Htmwn figure, edited by W.L. Strauss, New York, Dover, 1972; o. Schlemmer, Der Mensch, Mainz, F. Kupferberg Verlag, 1969.

A. Dürer, Figures built in eight modules, 1507 c.a.

O. Schlemmer, Figure axonometric with section pimzi, 1928 c.a.

A. Dürer, Male figures circumscribed by contomas stereometric, 1515wl519 c.a.

Table I

Fig. A

Frontal plan: front view of the perimeter of the figure; the total height of the figure measures eight times the height of the head

(8T). The basis is given by the measure of the height of the head multiplied by two (2T).

Fig. B

Axonometric representation of the frontal sagittal planes and of the transverse planes.

Fig. C.

Sagittal plane: lateral view of the perimeter of the figure. There base and equal to a pill il module its sixth $(T + 1/6 T) = \text{foot}$.

Fig. D

Plan axonometry sagittal.

Fig. E

Axonometry of the frontal plane.

Fig. F

Axonometry of the frontal planes and sagittal and volume overall.

Fig. G.

Plastic model of man in its volume.

- a. Anterior view
 - b. Posterior view
 - c. Lateral-posterior view
 - d. Side profile
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THE AXIS OF SYMMETRY

Let us now focus on some key points concerning both the structure both skeletal and myological apparatus of man to set clearly the relationships between the head, the trunk and the lower limbs. First of all, keep in mind the capital importance of the axis.

The vertical axis is for us the "place" of reference for all segments skeletal. By orienting the latter correctly, I respect to the axis, it is

possible to find the ratios of height, width and depth, essential to obtain a drawing conventionally correct with respect to lead(main axis?).

The following table presents three drawings that illustrate some of the three-dimensional reconstruction phases of the human figure. Let us consider pl. I, fig. A: the initial indication and given by the axis which crosses the form itself, thus placing itself as a measure of height and identifying some fundamental points in its path. These points are the "places" we will always refer to to set the relationships between the different parts.

Starting from the top, the first point that the axis identifies and places at the base of the skull, tangent to the joint between the skull and the first cervical vertebra, called "atlas" (plate I, fig. B1). Further down the board it intercepts in the center the plane of the upper cage orifice thoracic (fig. B2). Continuing it then goes to indicate the place of conjunction between the thoracic vertebrae, in relation to the ribs, and the lumbar vertebrae (fig. B3). From this point, going further down, the axis touches the promontory of the sacred and that is the articulation of the fifth lumbar vertebra with the pelvis, (fig. B4) and then reach at the knee, placing itself anteriorly to the trochlea of the femur (fig. B5). Finally, the axis descends again, anterior to the la ankle, reaching the base of the feet (fig. B6).

Ultimately, the axis we trace is none other than the lead of body, which, placing itself inside the support base of the feet, tell us how the body, in the upright position, is in a condition static balance that minimises muscle tension, weighing almost exclusively on the joint ligaments.

Table II

Fig. A
Initial indication of the axis.

Fig. B
Skeletal reconstruction in relationship with the axis.

1. atlas.
2. center of the upper orifice rib cage.
3. point of articulation between thoracic and lumbar vertebrae.
4. promontory of the sacred.
5. point of tangency on the axis of the toclea of the femur.
6. end point of the axis inside the base of the feet.

Fig. C

Skeletal and del plastic volume in relation to the axis.

Lesson 2

APPLICATION OF THE MODULAR SYSTEM AND RELATIONSHIP OF THE FIGURE IN THE SQUARE

THE MODULAR SYSTEM

Let's examine the table. 1 which presents the application of the modular system to the traces of the skeletal scheme¹

Figures A, B and E show us some phases of the reconstruction of the skeleton in the anterior view, while figures C, D and F present us the profile queue.

To understand the development of these tracks from the most elementary stages (figs. A-C) to the most elaborate ones, up to the overall definition of the skeleton (figs. E-F) it is important to pay attention to what follows.

The modular system allows us to set figure A with a ratio of two modules in width by a height of eight modules. The axis and the two are identified in this rectangle thus divided diagonals.

A first definition of the head (first module T) is given by trace of the two circumferences. The largest, placed at the top, is to indicate the volume of the skull and its diameter and equal to $\frac{2}{3} T$. The smaller one has a diameter equal to $\frac{1}{2} T$. A further measurement identifies the submodule F corresponding to the height of the face, which will be equal to one module minus its sixth ($F = T - \frac{1}{6} T$).

This measure F will then be distributed three times starting from half of the second module to the base of the fourth, and from the intersection of these measures with the diagonals and the axis we will obtain the identification of the following points:

- height and center of the heads of the humeri; sternal fork;
- terminal part of the sternum in its conjunction with the ensiform

process; maximum width of the thoracic cage and diameter of the circumference that allows us to reconstruct it graphically;

-belly button; maximum height of the iliac crests, defined by the arch of circle that will have as a radius the measure between the base of fourth module and chest circumference;

- symphysis of the pubis.

Further down, at the base of the sixth module, we find the dimensions of the knees: a knee will be $\frac{1}{2} T$ wide and tall equal to $\frac{1}{3} T$. This measurement of $\frac{1}{3} T$ includes the height of the condyles of the femur and that of the patella ($\frac{1}{6} T$) and the height of the condyles, of the tibia ($\frac{1}{6} T$).

The intersection of the diagonals with the horizontal plane that divides a half the height of the knees determines another key point, that it will be important for the definition of the knees themselves and for the diaphysis of the femurs and tibiae.

Still further below, $\frac{1}{3} T$ from the base of the last module, are placed the ankles which, together, will have a maximum width of $\frac{2}{3} T$.

Let's now see the profile setting (fig. C). First we will have need to report on the profile all the data relating to the heights obtained from figs. A and B, corresponding to the breakdowns into modules and submodules. The depth measure, in the profile, is defined by P, i.e. from the length of the foot and will be equal to $T + \frac{1}{6} T$.

A basic rectangle $T + \frac{1}{6} T$ and height $8 T$ is then determined. Particular attention should be paid to placing the axis of the figure in the middle Anterior of measure P.

-
1. skull
 2. face
 3. cervical vertebral tract
 4. collarbone
 5. shoulder blade

6. head area
 7. sternal fork
 8. sternum
 9. ensiform process
 10. rib cage
 11. dorsal vertebral tract
 12. lumbar vertebral tract
 13. promontory of the sacred
 14. sacrum
 15. hipbone
 16. superior iliac spine front
 17. iliac crests
 18. pubic symphysis
 19. head of the femur
 20. ischial tuberosity
 21. femur
 22. condyles of the femur
 23. condyles of the tibia
 24. patella
 25. trochlea of the femur
 26. tuberosity of the tibia
 27. tibia
 28. fibula
 29. malleoli
 30. foot
-

For the reconstruction of the profile of the head it is necessary to resort to the measurement of the diameter of the skull, equal to $\frac{2}{3} T$. By dividing it apart, we will identify the new segment, which we will call $\frac{1}{3} C$. depth of the skull will be equal to four times its length (fig. C).

Now let's move on to the rib cage. For a first definition the corresponding horizontal plane must be brought back from the front view to that of the maximum circumference of the rib cage. The intersection of this plane with the right edge of the rectangle in which the figure is inscribed, identify the center of the arch of circle that defines the rib cage in its anterior margin. The radius of this arc will be equal to the measure $P (T + \frac{1}{6} T)$.

In defining the basin in a lateral view it is necessary to repeat from the front view the small circle indicating the head of the femur (and with it the form of the acetabulum which it contains) so which is tangent in front of the axis. It will therefore be possible, starting from the lowest point of the pelvis (coinciding with the ischiatic tuberosities), in correspondence with the axis, draw a line oblique that is tangent to the head of the femur. This line, intersecting with that which corresponds to it, obtained from the vision anterior, identifies the tip coinciding with the anterior iliac spine upper, revealing the distance between the same and the promontory of the sacra, or from the axis. Reporting the same point further down, at the base of the fourth module, we will also find the pubic symphysis.

When defining the knee joint, keep in mind that its maximum depth is equal to $\frac{1}{2} T$ and that, except the patella, the knee is placed posterior to the axis.

We conclude with the ankle joint, which, as we have already seen, it is found at a height of $\frac{1}{3} T$, at a depth of $\frac{1}{3} T$ and is placed behind the axis.

We find in figures E and F the overall definition of skeleton and so are the observations we made in the lesson concerning the axis in the orientation relationship of the various segments skeletal with respect to it.

RELATIONSHIP OF THE FIGURE IN THE SQUARE

Continuing with our observations, we analyze the table. I, fig. A, where skeleton segments are redefined with the addition of the skeletal relationships of the upper limb in the subdivision arm, forearm and hand.

By rotating the upper limb perpendicular to the axis, we note that the whole figure of the man with open arms can be ideally inscribed in a square and that, in this condition, the height same as man from head to toe corresponds to extension of man with open arms.

In fig. The analogy with the Vitruvian image of man is evident with legs and arms outstretched, inscribed in geometric shapes perfect,

such as the circle and, precisely, the square, image that we find it in a code by Francesco di Giorgio Martini and reinterpreted in the famous drawing by Leonardo preserved in Venice²

These forms and patterns refer to complex symbolic themes which, starting from Vitruvius, have engaged the theoretical reflection of artists, architects, mathematicians and writers, especially in the fifteenth century, about Armenia and the perfection of the human body which measure of << all things in the world >>

1 This scheme was reworked on the basis of proportional studies by F. Meyner, *Kiinstler Anatomie*, Leipzig, Seemann, 1951.

2 Francesco di Giorgio Martini, *Treatises of Architecture, Engineering and Art military*, in *Treaty of Architecture*, a edited by Renata Borelli and Paolo Portoghesi, vol. III, Milan, Il Polifilo, 1967; *Leonardo and Venice*, Milan, Bompiani, 1992, fig. 12, pp. 216- 217.

3 See Cesare Cesariano, *Di Lucio Vitruvio Pollione de Architectura*, Como 1521; and for further information of the whole matter see Wittkover, *op. cit.*, pp. 18-22.

Fig. A
Modular ratio of the square

Fig.B
Three-dimensional analysis in stillness and motion. The human figure is observed in primary volumes.

Francesco di Giorgio Martini, *Homo ad quadratum*, Codex Saluzziano, n° 148, fol. 6v.

Leonardo da Vinci, *Homo ad quadratum*, (1490 c.a.), n. 228

Cesare Cesariano, *Di Lucio Vitruvius Pollione, de Architectura*, Como 1521, fol. CXLIX r.

Fig. A

Comparison of two systems of modular breakdown of square net (grid ?) figure of Vitruvian inspiration.

In the left half of the table we have a scan modular in 8T (eight times the head). In the right half we notice as the modular ratio and given by measure C (skull x 12 times).

Lesson 3

STRUCTURE AND PLASTIC FORM OF THE HUMAN FIGURE

Let us consider the human figure once again in the totality of its shape. If we add the muscle parts to the skeleton, we get a new peripheral and perimeter tracing of the form itself.

The table I, fig. A presents the modular skeletal layout already seen in lesson 2 (plate I, figs. E-F), and superimposed on it the scheme volumetric of muscle forms. In this, and to follow also in figs. B and C, we can note the points where skeletal structure (internal) and myological structure (external) connect in a way to be "read" even with the naked eye, just below the surface of the skin.

We will therefore notice how the skeletal perimeter has points of surface tangency with the overall perimeter of the figure. To for example, we could say that the final shape of the foot is almost coinciding with its skeletal form, as well as at the height of ankle the malleoli, medial and lateral, are immediately below the skin.

This relationship between inside and outside, made visible by the surfacing under the skin of some points of the osteological structure, there allows, in reading the current model, to go back to its complete reconstruction.

In fact (figs. B-C), in addition to the malleolus-1, they are subcutaneous emergencies also visible the inner face of the tibia-2, the knee-3, the trochanter- 4, the pubis-5, the anterior superior iliac spines-6, the iliac crests- 7, posterior superior iliac spines - 8, part of the rib cage - 9, The lower angle of the scapula-10, The spine of the scapula up to the acromion-11, the upper margin of the clavicles-12 and buena part of the head-13.

With this we want to underline the importance of the interconnection points between the skeletal and myological

structure and how, by drawing in "transparency", it is essential to know how to identify them and recognise.

By carefully observing fig. D, we note that the axis divides the form into two asymmetrical parts. If in the anterior view the axis divided the figure into two mirror halves, in the profile it puts in evidence a different distribution of the masses according to one sinusoidal trajectory, that is through a series of opposite curvatures. Let us therefore analyse fig. D, proceeding from below upward. At the height of the ankle, the relationship between the tibial tract and the foot, that is the ankle-tarsal joint-1, is posterior to the axis. Always posterior to the axis and the muscle mass of the gemelli muscles-2, in leg stretch. The axis is placed anterior to the trochlea of the femur, in the knee section-3, and the quadriceps mass-4, in that of the thigh moves forward, creating a curvature opposite to the first. Later it is balanced by the mass buttocks-5. A new curvature characterises the abdominal tract- 6, balanced, posterior to the axis, by the opposite curvature at the shoulder blade and in the thoracic part of the spine 7. This balancing game, which ends with the condition barycentric of the head-8, and represented graphically by the sinusoidal line in red.

Fig. E indicates the tensions of the muscles responsible for upright posture. The affected muscles are as follows:

- triceps of the sura, composed of the soleus and the gemelli muscles, which extends 1st leg on foot -1;
- biceps, which extends the thigh on the leg -2;
- buttocks, which extend the pelvis on the lower limb -3;
- erector muscles of the vertebral column, i.e. the sacrospinal and ileum-costal, which they support, as tie rods of a tense structure, la part of the trunk(torso ?) -4;
- trapezius, which supports the head -5.

Summarising, therefore, to a posterior displacement of the gemelli muscles corresponds anteriorly that of the quadriceps of the thigh and I refer to this a posterior displacement of the buttocks. At the height of the trunk there is a slight anterior displacement of the abdomen to which follows, posteriorly, that of the back and shoulder blade. By and large a condition of equilibrium is

determined which is found in tests its definitive barycentric condition.

It is worth reiterating, at the conclusion of this third lesson, that for correctly interpreting the drawing of the figure is essential learn to see and precisely define the balance relationships and tensions between the masses.

Fig. A, B, C

Modular skeletal layout and plastic forms.

1. malleoli
2. inner face of the tibia
3. knee
4. trochanter
5. pubis
6. anterior iliac spine superior
7. iliac crest
8. posterior iliac spine superior
9. rib cage
10. lower corner of the scapula
11. spine of the scapula and acromion
12. upper margin of clavicle
13. head

Fig. D

Side profile: distribution of muscle masses in relationship to the structure of the skeleton.

1. ankle joint
2. muscle mass of gemelli muscles
3. knee
4. quadriceps
5. buttocks
6. abdominal tract
7. angle of the scapula
8. head

Fig. E

Side profile: the muscle tension lines responsible for upright posture.

1. triceps of the sura
 2. biceps
 3. buttocks
 4. sacrospinal and iliocostalis
 5. trapezoid
-

Lesson 4

APPLICATION OF THE MODULAR STRUCTURE

We now propose some drawings which introduce slight variations of relationships with respect to previous schematisations¹.

The schemes, in fact, do not have to intended as a limitation to the interpretative possibilities, but as effective mutable tools of work. The proportional scheme which follows, both in its elementary version (plate I, figs. A-D), is completed by the reconstruction of the structure skeletal (figs. B-C-E), constitutes a valid study and offers the reader a further one possibility of investigation on modular subdivision theme of the human figure.

¹ This is a reworking from the proposed proportional scheme by G. Bammes in Die Gestalt des Menschen, Dresden, VEB, Verlag der Kunst, 1991.

Figs. A, B, C

Modular scheme of the perimeter of the human figure in visions front and rear:

processing taken from G. Bammes, Die Gestalt des Menschen.

T head module

F face = $(T - 1/6 T)$

C skull = $(2/3 T)$

G rib cage = $(T + 1/3 T)$

Scapula 1 / 2F

Elbow 1 / 3F

Wrist 1 / 3C

Carpus 1 / 3F

Palm 1 / 2F

Spine base 1 / 3C

Maximum basin width $F + 1 / 3T$

Minimum basin width C

Knee $1/2F$

Ankle $1/3F$

Foot Base $2/3 C$

Fig. D, E

Modular scheme of the perimeter of the human figure in visions lateral.

P foot = $(1T + 1l 6T)$

Pulse $1/3C$

Forearm $1/3C$

Maximum basin depth C.

Knee depth $2/3C$

Condyle femur $1/3C$

Dorsal foot height $1/4T$

Lesson 5

THE PELVIS

It constitutes the lower part of the trunk and has the function of containing in its expanded space the abdominal viscera. And also an element joint connection between the trunk and the lower limbs: in fact posteriorly supports the vertebral column, weighing at the same time forward and externally on the lower limbs.

Also understood as the pelvic girdle, it consists of three articulated elements between them: the sacrum, placed behind, along the middle, the two bones of the hip or iliac which, articulating to the sacrum, expand externally forward and reunite in the symphysis of the pubis.

Iliac bone

Before undertaking a more overall reading of the pelvis, let's try to identify the individual "geographical locations" of the iliac bone. It turns out composed of three distinct segments called ilium, ischium and pubis are united by cartilage until puberty, and merge into the acetabulum, ossifying, in adulthood, with an interline of shaped suture of Y (plate I, fig. A).

Ilium

It includes the upper part of the acetabulum and the upper portion flat and expanded, called the wing of the ilium. The anterior margin of the wing has two reliefs, the anterior inferior iliac spine (Table I, fig. 81), and the superior anterior iliac spine (fig. 82). This is in continuity with the iliac crest (fig. 83) which in turn determines the upper margin of the wing. The posterior margin also presents two reliefs, the posterior superior iliac spine (fig. C11) and, beyond below this, the posterior inferior iliac spine (fig. C12), and ends with a deep notch called the large ischial notch (fig. C13). The outer surface of the wing is convex with two linear reliefs, the anterior and posterior gluteal lines, insertion arches for the muscle bundles of the hip (Figs. Ag-g1). The surface internal, however, has a slight

concavity, called pit iliac (fig. B4), delimited at the bottom by a bony relief called arcuate line (from the ilium) (fig. B5) which, anteriorly, joins the iliopubic eminence of the pubis and, posteriorly, towards the articular surface connection between the ileum and the sacrum called the auricular surface, so called for its shape reminiscent of the pavilion of the ear.

Ischium

Includes the lower and rear part of the vinegar bolus. Its posterior margin, in continuity with the greater ischial notch, has a sharp relief called the ischial spine (fig. C14) and, after the lesser ischial notch (fig. C15), it expands into a relief massive and trapezoidal called ischial tuberosity from which the biceps originate (fig. C16), and the branch begins inferior of the ischium (Fig. C17).

Pubis

It forms the lower and anterior part of the acetabulum from which the upper branch (fig. B6) which, moving forward, ends in lower margin with a pronounced relief, called the pubic tubercle (fig. B7). From this begins the lower branch (fig. B9) that it presents medially the articular facet for the symphysis, called pubic facet, la which is joined to the between pubic facet by means of an articulation cartilaginous type called symphysis of the pubis (fig. B8), compound by two ligaments and a fibro-cartilaginous interpubic disc (Pubic symphysis?). The lower branch (fig. B9), moving downwards and backwards, it merges with the lower branch of the ischium, and creates a circumscribing arch a hollow area, called the obturator foramen (fig. B10).

Fig. A Pelvis lateral profile.

l. ileum
i. Ischia
p. pubis
a. acetabulum
s. sacrum
g. anterior gluteal line
gl. posterior gluteal line

Fig. B Pelvis anterior front view.

1. anterior iliac spine inferior
2. anterior iliac spine superior
3. iliac crest
4. iliac fossa
5. arched line
6. superior pubic branch
7. pubic tubercle
8. pubic symphysis
9. inferior pubic branch
10. obturator foramen

Fig. C. Front view pelvis Posterior

11. Posterior iliac spine superior
12. posterior iliac spine inferior
13. greater ischial notch
14. ischial spine
15. lesser ischial notch
16. ischial tuberosity
17. inferior ischial branch

Fig. D

Posterolateral (posterior and lateral) view. Lateral of the pelvis

Sacrum

Although the sacrum belongs to the spinal column (see Section 23), it also contributes to the formation of the iliac vessel. The sacrum looks like a pyramidal shape curved on itself itself (plate II, fig. E) with the main base facing up and apex down. On the upper base we note the articular face for the V lumbar vertebra (fig. A1) which receives the weight of the trunk.

The sacrum, due to its angular structure, it transmits the load diagonally, outwards and downwards through the articular faces called auricles (fig. B2) concomitant with those of the iliac bone. In this way the two iliac bones articulate posteriorly to the sacra with Their articular auricular surface (pl. III, fig. B1), while, anteriorly, they gather in the pubic symphysis through the facets pubic. Thus it is possible to determine a bony ring that transmits the load of

forces from the spine to the lower limbs (plate II, fig. F3).

The basin can be divided geographically into two areas: the large pelvis, placed at the top, and the small pelvis, placed at the bottom, respect to an ideal line which, starting from the promontory of the sacra (pl. ill, fig. A2), descends by the arcuate lines (fig. A3) and joins the symphysis following the setting of the basin vessel and orienting itself indicatively at 45° with respect to the vertical axis of the lead. The big one pelvis and bounded mainly by the bone plate it takes the name of the wing of the iliac bone, which constitutes the posterior part and lateral of the ideal vessel for containing the viscera and internally it has a concave shape which determines the pit iliac (fig. A4). The outer wall of the wing will be the main site of insertion of the most important muscles that determine the erected station in man.

The small pelvis consists of the upper branch of the pubis (fig. A5) up to the symphysis, to which the lower branch (fig. A6) is connected it connects to the more expanded and posterior mass of the tuberosite ischial (fig. A7), an important place for the origin of muscle bundles which also contribute to the upright position. Thus a further ring, which circumscribes the hollow area called the obturator foramen (fig. A5), because it is closed by a fibrous membrane (obturator membrane). On the external wall of the iliac bone and in a central condition in the point of greater structural solidity than the form, is the acetabulum (fig. Ba), ideal hinge point between the two areas of the grandee of the small pelvis; it is a hemispherical joint cavity which it forms the surface on which the head of the femur slides into the joint of the hip. The two iliac bones have the greatest thickness along the entire perimeter and along the arched line, giving thus a greater resistance to the forces of compression and traction.

Fig. A

Sagittal section of the pelvis and its orientation to respect leaded.

2. promontory of the sacra
3. arched lines
4. iliac fossa

5. upper branch of the pubis
6. inferior branch of the pubis
7. ischial tuberosity
8. obturator foramen
9. pubic facet

Fig. B

Front view of the pelvis.

1. auricular surface
- a. acetabulum and femoral head in transparency
- p. plumb (main axis)

Fig. C

Anterolateral view of the hip bone.

Fig. A

Sacrum Anterior view.

Fig. B

Side profile.

Fig. C.

Rear view.

Fig. D

Anterolateral view.

Fig. E

Anterolateral view, its structure highlighted pyramidal

Fig. F

The sacrum in relation to the form elliptical of the arcuate lines.

1. face articulator for the V(5th?) lumbar vertebra
 2. auricular articular face
 3. trend line of the arcuate lines
-

Lesson 6

THE BASIN: ANALYSIS OF THE STRUCTURE AND ITS RECONSTRUCTION

To better understand the shape and to be able to reconstruct it graphically we will identify some fundamental plans.

Examine pl. I, fig. A. We start from the vertical axis P (coinciding with the general lead of man) and identify a horizontal plane passing through the anterior superior iliac spines (point 1) and the posterior superior iliac spines (point 2). This plane will meet the axis at point S (slightly below the promontory of the sacrum).

Let us now analyze fig. B. It describes the form in its internal profile. It should be noted that the anterior superior iliac spines (1) and the pubic protrusion (3) are tangent to a vertical plane (see three-dimensional development, fig. G). Consequently, a plane (of elliptical form) inclined by 45° with respect to the P axis, which will meet the latter at point S and which underlines the inclined trend of the arcuate lines.

To these three main planes of orientation we can add an inclined plane which, starting from the anterior superior iliac spines (1) and passing through the anterior inferior iliac spines, joins the base of the ischial tuberosity (4).

Finally, by connecting point 4 to point 2, we identify a posterior plane which is tangent to the maximum protrusion of the ischial tuberosity and to the posterior inferior iliac spine, which we will see better highlighted later. in table II, figs. A-D.

Taking into account the data previously acquired in the report by orientation of the pelvis with respect to lead and applying this initial scheme within a scan of modular relationships (table II, figs. A sgg.) which allows us to understand the form better in its relationships overall, there we can approach a three-dimensional reconstruction of it managing it in the your data of depth, height and width.

Fig. A

Pelvis: anterior view.

1. anterior iliac spine superior
2. posterior iliac spine superior
3. Pubic prominence
4. base of the ischial tuberosity
- S. promontory of the sacred
- P. lead or main axis

Fig. B

Pelvis: internal profile.

1. anterior iliac spine superior
2. posterior iliac spine superior
3. pubis
4. base of the ischial tuberosity
- S. promontory of the sacrum
- P. lead (main axis?)

Fig. C

Pelvis: posterior view.

1. anterior iliac spine superior
2. posterior iliac spine superior
4. base of the ischial tuberosity

Fig. D

Pelvis: anterior view plastic form.

Fig. E

External profile.

Fig. F

Posterior view.

Fig. G.

Pelvis: lateral-anterior view of the main planes.

Now we will apply the section tool to understand the plastic

peculiarities of the pelvis shape.

In table II figs. F and G represent three levels of section of the pelvis seen from above. In particular, fig. F shows the section (a) placed at the level of the centre of the acetabulum and the ischial spine, and the section (b) that follows the trend of the arched lines.

Fig. G describes in the right half section (c), placed at the level of the anterior superior iliac spine (1), thus dissecting the wing of the ileum and showing us its characteristic S-shaped course. The other half of fig. G presents the shape of the iliac bone in its entirety, highlighting its helical torsion movement: iliacus derives from the Greek ileon which means helix, and in the frontal view it appears precisely similar to a helix more expanded towards the top and with the ideal pin placed in the acetabulum (fig. C).

Fig. A

Lateral view in modular relationships.

T module (1)

r. acetabulum radius

1. anterior iliac spine superior

3. Pubic prominence

P. lead (main axis?)

Fig. B

Anterior view in modular relationships.

1 anterior iliac spine superior

3. Pubic prominence

4. base of the ischial tuberosity

S. promontory of the sacred

P. lead(main axis?)

Fig. C.

Right portion vision front: definition of plastic forms.

Fig. D

Lateral view: definition of plastic forms.

from point 4 to point 2: posterior plan

- 2. posterior iliac spine superior
- 5. ischial tuberosity
- 6. ischial spine
- 7. posterior iliac spine inferior

Fig. E
Posterior view

(1)

In a reconstruction through the modular proportions of the whole man figure remember that the pelvis throughout its height corresponds to its height of the head, therefore to a module T.

Fig. F
View of the pelvis from above.

Section a . : section plane passing through the centre of the vinegar bolus.

- a. acetabulum
- 6. ischial spine

Section b .: section plane loop with curved lines.

Fig. G.
Top view of the pelvis.

Section c .: section plane passing through the iliac spine anteriore superior (point 1)

Fig. A
Horizontal plane:

- 1. anterior iliac spines superior
- S. sacrum promontory

Front front vertical plane:

- 1. anterior iliac spines superior
- 3. Pubic prominence

Fig A1

Horizontal plane and section a level of the iliac spines
front and posterior and definition of the iliac crest.

2. Posterior iliac spines superior

Fig. B

Oblique plane:

1. iliac spines

4. base of the ischial tuberosity

Fig. B1

45 ° inclined plane from point 3 at point S and section at the level
of the arcuate lines.

Fig. C.

Intersection between the two oblique (tilted) planes from point 1
to point 4.

45 ° inclined plane - trajectory from pubis point 3 to the
promontory sacrum point S.

Fig. C1

Definition of the lower structure
of the pelvis (small pelvis).

Representation three-dimensional from a point of anterolateral
view of the pelvis, in his relationship with the main construction
plans

Table IV

Representation three-dimensional from a point of posterolateral
view.

Fig. D

Definition of the form overall right ileum in relationship with the sacrum and section of the sacrum in the median.

Fig. D1

Detail of the hemispheric cavity of the acetabulum.

- a. fossa of the acetabulum
- b. articular surface for the head of the femur called semilunar.

Fig. E

Definition of the overall form.

Fig. A

Posterior plane:

- 2. posterior iliac spine superior
- 7. posterior iliac spine inferior
- 4. base of the ischial tuberosity

Fig. B

Posterior plane:

- 5. ischial tuberosity
- 6. ischial spine
- 7. posterior iliac spine inferior
- 2. posterior iliac spine superior
- 8. auricular surface

Fig. C.

Overall volume.

Lesson 7

THE SKELETAL DEVICE OF THE LOWER LIMB: THIGH, LEG

All human limbs are made of long bones, elements that they perform two functions: support and movement.

Unlike the upper area, which mainly performs the motion function, the lower limb, composed of the femur in the segment of the thigh and the tibia and fibula in the tract of the leg, and affected by both functions. Hence the relevance of the weight and muscle forces to which it is subjected demands that it has characteristics of solidity and stability, which are ensured with greater bone volume.

If it is true that the execution of the forward movement is facilitated and accelerated precisely by the smallness of the support base of the feet, caused by their approach due to the oblique condition of the diaphysis, and yet it is evident that the stability of the body is guaranteed by the unloading of its weight along the mechanical axis, which it touches the articular centres of the skeleton and, consequently, along the axis intrinsic anatomical to the skeletal form itself.

If they examine the whole lower area in the symmetrical standing position (table I, fig. A), we can see that the weight of the whole upper half of the body and loaded on the sacrum (fig. A.3) and is unloaded obliquely to the outside on the hips. In the cavity of the acetabulum (fig. A4), the hemispherical head of the femur receives the load and carries it oblique towards the outside, on the greater trochanter (fig. A.3). In turn, the greater trochanter conveys it along the body of the femur, from outside to inside, from top to bottom, up to the knee. Then, from the tibia down in a slight oblique direction, always from the outside to the inside, the weight is discharged on the joint of the ankle. The latter distributes it on the support points of the foot, on the ground, which are the heel (fig. A6) and the heads of the metatarsal bones (fig. A7).

Consequently, the points most stressed by the weight are: the

segment that goes from the head of the femur to the greater trochanter passing for the glue of the femur (table I, figs. As-B); the astragalus (figs. A9-C), which receives on itself the compression of the weight of the whole body, releasing it on the tarsus and metatarsus.

Fig. A

Anterior diagram of the skeleton of the lower limb.

- p. axis
 - b. hip bone
 - f. femur
 - t. tibia
 - pe. fibula
 - pi. foot
 - 1 femoral head
 - 2 shaft of the femur
 - 3 sacrum bones
 - 4 acetabulum
 - 5 greater trochanter
 - 6 calcaneus
 - 7 metatarsus
 - 8 neck of the femur
 - 9 astragalus
-

Fig. B

Hip joint.

- 1. Detail of the joint of the right hip: we note the weight load line
 - 2. Acetabulum and femoral head: called spheroidal joint "ball joint" enarthrosis, consisting of a spherical head which is housed inside a cup-shaped concavity
 - 3. Detail: head, neck and greater trochanter of the femur
-

Fig. C.

Left talus in his joint relationship with i malleoli.

In table II they are highlighted in the diagram of the lower limb i two axes mentioned above: mechanical axis or load-bearing line of the limb (m); anatomical axis (a).

The mechanical axis joins the centre of the hip joint (centro of the head of the femur: fig. A1) in the centre of the ankle malleoli (fig. A2), and, passing through the centre of the knee joint, transmits the weight of the trunk to the foot.

The anatomical axis starts from the centre of the articulation of the knee (spine of the tibia and intercondylar notch: figs. A3-C), continues inside the shaft of the femur (fig. A4), reaching the height of the greater trochanter, then moving to the centre of the femoral head with an angular degree from 125° to 130° (fig. A5).

The anatomical axis of the femur, intrinsic to the shape, creates a angular value of 10° - 12° with respect to the mechanical axis, calculable value at the knee, in the centre of the intercondylar notch (figs. A6-C). In the case of the tibia, however, the anatomical axis coincides with the mechanical axis.

Fig. A

Anterior view.

m. mechanical axis

a. anatomical axis

1 femoral head

2 intermalleolar area

3 spine of the tibia

4 diaphysis

5 angle between diaphysis and glue of femur (125° - 130°)

6 angle between the a axis and the m axis
(10'-12 ')

Fig. B
External profile.

Fig. C.
Posterior view.

Fig D.
Internal profile.

Lesson 8

MODULAR PROPORTIONS OF THE LOWER LIMB IN THE SYMMETRIC STATION

After the introductory lesson on the structural characteristics and the axial orientations of the lower limb and before moving on to an investigation specific on the individual skeletal elements that compose it, let us take into consideration the modular relationships seen in lesson 2 (plate 1).

Fig. A
Lower limb skeleton in modular relationships.
Frontal anterior view.

The total height of the pelvis is equal to module T which, divided into three equal portions, identifies, starting from the top, the plane of the iliac spines and the centres of the ankle joint.

The pelvis must be placed lowered by $\frac{1}{6}$ T with respect to the base of the fourth module.

The knee joint is located at the base of the sixth module, contained in two heights; $\frac{1}{2}$ T (from the patella to the tuberosity of the tibia); $\frac{1}{3}$ T (from the patella to the head of the fibula).

The foot is contained in the height of $\frac{1}{3}$ T (from the ankle joint to its base). For the width measurements, respectively:

1 T for the distance of the superior anterior iliac spines.

$\frac{1}{2}$ T for the base of the pelvis

$\frac{1}{2}$ F (I) for the single knee in the plane articulate

$\frac{1}{3}$ T pearl ankle from lead to the malleolus lateral

The T for two feet (also considering the medial interspace)

Fig. B

Lateral profile in standing position seen in the maximum extension of the skeleton. Note the points of the skeleton in relation to the plumb axis P.

s. promontory of the sacra

1 base of the ischial tuberosity

2 trochlea of the femur

3 tuberosity of the tibia

4 the foot in its middle (point of articulation between the tarsus and metatarsus)

The measurement of the width of the knee - from the trochlea to the condyles
and equal to $\frac{1}{3} T$. The foot size corresponds to $1 T + \frac{1}{6} T$.

Fig. C.

Front and rear view with reconstruction of the anatomical and mechanical axes.

Anatomical axis of the hip: it is placed starting from the promontory of the sacra (1) in the center of the greater trochanter (3).

Anatomical axis of the femur: from the greater trochanter (3) to the center of the knee joint (4).

Mechanical axis of the femur: from the center of the femoral head (2) to the center of the knee joint (4).

Anatomical axis of the tibia: it is placed in continuity with the mechanical axis of the femur (2-4 → 5).

(1)

For F is meant the measure of $(1/T - 1/6T) = F$: this measure corresponds to the size of height of the man's face.

Lesson 9

SKELETON OF THE THIGH: THE FEMUR

The femur, which constitutes the skeleton of the thigh (Plate I), is a long bone with dilated ends in joint shapes and a sturdy one cylindrical diaphysis (fig. A1) with a slightly curved course and with a robust posterior relief with a rough surface, called [linea aspera](#) (Latin: rough line) (fig. C2). The linea aspera is composed of two raised lines, called the medial lip (fig. C3) and the lateral lip (fig. C4), with the function of insertion of the thigh muscles.

The upper extremity is given by a head (fig. A5), a cap of $\frac{2}{3}$ of sphere with smooth articular surface. At its top we notice the dimple of the round ligament (fig. A6), ligament that leads to the fossa of the acetabulum connecting the head in the joint of the femur within the hip cavity.

Next, we note the neck of the femur (fig. A7), which joins the head to two protruding tuberosities, a larger one, known as the greater trochanter (fig. A8) and a smaller conoid-shaped one, the lesser trochanter (fig. A9). Both are connected to each other, anteriorly, by the intertrochanteric line (fig. A10), and, posteriorly, by the intertrochanteric crest (fig. C11), the latter more raised. The greater trochanter is the centre of insertion of the hip muscles.

Posteriorly, below the greater trochanter, we note the outlining of a wrinkled longitudinal imprint called *tuberosita glutea* (fig. C12), the area of insertion of the muscle *gluteus maximus*. Always from the greater trochanter two lines originate which converge on the median, forming, as we have already seen, the posterior margin of the femoral diaphysis, a wrinkled relief that takes precisely the name *linea aspera*. Proceeding downwards, the two lines diverge until they form a triangular plane called the popliteal plane (fig. C13).

In the lower extremity the diaphysis expands into a massive body and its shape is more understandable if we analyse its joint function. We therefore note, starting from the posterior view, in continuity with the popliteal plane, two cylindrical carpi called condyles. The medial condyle (fig. C14) and the lateral condyle (fig. C15) are separated by a joint cavity, called the intercondylar notch (fig. C16).

The condyles act as articular rollers, which allow, sliding on the articular surface of the tibia, to obtain the main movements of extension and flexion of the femur on the tibia itself - joint movement called angular ginglimo (see also table II). In the drawing (Table I) the relationship between the femur and the tibiae is proposed as in its natural condition, given the oblique course of the femur with respect to the horizontal plane of the joint with the tibia. If we imagine a plane of connection between the two condyles, we notice how the medial condyle is higher than the lateral condyle. This diversity sets the oblique course of the femur, giving greater solidity to the skeletal structure.

The condyles then expand their articular surface which leads anteriorly, uniting in a single area with a smooth surface called the trochlea (fig. A17). We observe along the median line of the trochlea a base called trochlea gala (fig. A18) on which the posterior face of the patella fits (fig. B19). Ultimately, on the medial and lateral profile above the condyles we have two protrusions, the medial epicondyle (fig. A20) and the lateral epicondyle (fig. A21), to which the collateral ligaments of the knee lead (pl.I, lesson 11), the tibial (figs. A-C3) and the fibular (figs. A-B4).

Fig. A
Frontal Anterior view
Right thigh skeleton.
f. femur
r. patella
1. diaphysis
5. head
6. Dimple round ligament
7. neck of the femur (Collum Femoris)

- 8. greater trochanter
- 9. lesser trochanter
- 10. intertrochanteric line
- 17. trochlea
- 18. gala of the trochlea
- 20. medial epicondyle
- 21. lateral epicondyle

Fig. B

Side profile view.

- 19. Posterior face of the patella
- 21. Lateral epicondyle

Fig. C

Frontal Posterior view.

- 2. linea aspera
- 3. medial lip
- 4. lateral lip
- 11. intertrochanteric crest
- 12. tuberosita glutea
- 13. popliteal floor
- 14. medial condyle
- 15. lateral condyle
- 16. intercondylar notch

In table II we can see that, for a reconstruction of a complex shape such as the articular apparatus of the knee, we can start from a simple shape with an easy spatial intuition, for example a parallelepiped (fig. A), and through its semi-composition by planes, redefine the elements of the skeletal form in question.

Understanding the form in its essential volume will be useful for the graphic representation, even more so if we think of the paths and the multiple points of view of such a complex and articulated structure as we can also see in the examples of table III.

The proportions of the parallelepiped (fig. A) can always be

obtained from the modular ratios (see lesson 8):

segment height: $a-b = 1/6 T$.

segment width: $b-e = 1/2 F$

segment depth: $e-d = 1/3 T$

Fig. A

Volumetric reconstruction of the articular apparatus of the femur and tibia: anterolateral view of the left knee. Modular reports:

segment $a-b = 1/6 T$

segment $b-e = 1/2 F$

segment $e-d = 1/3 T$

Fig. B

Definition of the section plane placed above the condyles of the femur at the point of junction with the popliteal plane of the femur.

Fig. C.

The sectional plane is more expanded posteriorly than anteriorly, given the difference wide between the condyles posterior and the anterior trochlea.

1. medial epicondyle
2. lateral epicondyle

Fig D.

Overall volume.

3. medial condyle
4. lateral condyle

Fig. E

5. definition of the condyles of the tibia
6. tuberosity of the tibia

Fig.F

Overall form

7. trochlea
 8. gala of the trochlea
-

Fig. A

1. Flexion of the lower segment of the femur on the right leg viewed posteriorly and laterally
2. detail of the volume of the solid knee, seen in flexion from the same point of view

Fig. B

Articulation in 90° flexion of the left limb with the exclusion of the patella. We can see the fibular collateral ligament.

In the lower extremity the malleoli contain the talus seen in the form of a cylindrical solid.

Fig. C and D

Three-dimensional examples of reconstruction of the skeleton of the thigh and of the right leg in extension. The trajectories of the anatomical axis and of the mechanical axis and the volume of the solid of the knee can be noted.

Lesson 10

THE SKELETON OF THE LEG: TIBIA AND PERONE OR FIBULA

By skeleton of the leg we mean the segment between the thigh and the foot, consisting of a more voluminous bone, which is the tibia, and the fibula, located laterally.

The tibia (Plate I) as a long bone also has a body and two articular ends, of which the upper is more voluminous.

The body is distinctly prismatic, with a triangular section with an anterior margin at an acute angle; of the two anterior faces, one is facing anteriorly and medially and its surface is in large part flush with the skin (fig. A1 and section); the other front face (fig. A2) and covered on the side by the muscles of the leg. The third face, facing posteriorly (see section and fig. G), is covered by the posterior muscles.

The shape of the prismatic body consequently has three margins: one, facing anteriorly and placed directly under the skin, more commonly known as the "shin"; the other two are the medial and the lateral margin; the lateral margin hidden by the muscles and intimately linked to the fibula by a membrane. Table I interosseous membrane (fig. A4 see section) connecting the two skeletal segments is placed between the anterior and posterior muscles and creates a useful plane for the attachment of some of these muscles.

The upper extremity, more developed than the lower one, is a long "cup" to support the condyles of the femur, offering a support surface for the joint. The surface is composed of two prominent masses, the medial (fig. A5) and lateral (fig. A6) condyles, which are more expanded and protruding posteriorly (fig. B) and transverse (fig. C) with respect to the diaphysis, thus constituting an adequate support surface for the weight of the body transmitted by the femur.

Fig. A (section)

Relations between skeletal and muscular forms.

t. tibia

p. fibula

t.a. tibialis anterior

e.l.d. long extensor of the fingers

p.l. **Peroneus longus**

t.p. tibialis posterior

f.l.d. long flexor of the fingers

s. soleus

g.c.l. lateral head gastrocnemius

g.c.rn. medial head gastrocnemius

Fig. A

Anterior view of the skeleton (right leg).

t. tibia

p. fibula or fibula

to. astragalus

1. medial face

2. lateral face

4. section - interosseous membrane

5. medial condyle

6. lateral condyle

11. tuberosity of the tibia

15. medial malleolus

16. lateral malleolus

17. head of the fibula

18. styloid apophysis

20. point of articulation between the tibia and fibula

Fig. B

Side view.

Fig. C

Posterior view.

- 3. posterior face
 - 9/10. spines of the tibia
 - 13. popliteal line
 - 14. articular face for the trochlea of the talus
 - 19. sulcus for the tendon of the [Peroneus longus](#) muscle
 - 21. Articular facet for the talus
-

The condyles of the tibia present in the surface facing the condyles of the femur (fig. D) two cavities, which are articular faces (figs. D7-D8), called glenoid cavities. These slight cavities are interspersed with two reliefs called spines, of which that of the lateral condyle (fig. D9) is more anterior than the other. The thorns of the tibia (figs. D9-D10) form a true and just interlocking articulate with the notch intercondylar of the femur and offer attachment to the [cruciate ligaments](#).

Fig D.

Volumetry studies and analysis of the left tibial plateau.

- 5. medial condyle
 - 6. lateral condyle
 - 7 | 8. Glenoid cavity
 - 9/10. thorns
 - 12. articular facet for the head of the fibula
-

Lesson 11

The Rotula or Patella (The Kneecap)

The patella (see also table I, lesson 9, figs. A-B19) is a sesamoid bone (a bone embedded within a tendon or a muscle), similar in shape to a sesame seed, placed anterior to the knee joint and represents a case of interposition of a small bone in the thickness of the patellae which knits on it. It has a convex anterior face (fig. A19) and a posterior face with two facets (fig. B19) which articulate with the trochlea.

The patella (table I, fig. A) is positioned anterior to the trochlea of the femur and is encapsulated by the bundles of the patellar ligament (fig. A1), which originates from the tuberosity of the tibia and from the bundles of the patellar tendon, the terminal part of the rectus muscle of the femur (fig. A2). In this way, the function of the patella would allow the tendon itself not to be compressed and squeezed in the phases of movement, in particular in flexion, when it comes directly into contact with the articular surfaces.

Fig. A

Anterior view of the skeleton and of the main ligaments of the knee.

1. Patellar ligament
2. patellar tendon
3. Tibial collateral ligament
4. fibular collateral ligament
5. lateral meniscus
6. medial meniscus

Fig. B
Side profile.

Fig. C.
Medial profile.

Fig D.
Anterior lateral view of the upper extremity of the left tibia.

- 5. lateral meniscus
- 6. medial meniscus
- 7. tuberosity of the tibia
- 8. interosseous membrane

Fig. E
Anterolateral view.

Left knee and section of the quadriceps muscles of the thigh.

- 1. Patellar ligament
- 2. Patellar tendon and section of the rectus femur muscle
- 9. vastus lateral muscle
- 10. vastus medialis muscle
- 11. vastus intermediate muscle

Fig.F
Anterolateral view. Volumetric reconstruction of the muscles of the quadriceps group of the thigh.

- 2. rectus femur

9. vastus lateral

10. vastus medialis

11. vastus intermediate. It is a deep muscle hidden by the rectus muscle of the femur (compare fig G)

12. origin of the rectus femur muscle - anterior inferior iliac spine

Lesson 12

KNEE JOINT

The joint between the femur and the tibia (Table I) and an angular ginglymo diarthrosis. This articulation generates a bending movement (fig. A1-2) and extension (fig. D). To these main movements we can add a rotation movement that occurs only when the joint is in flexion; in this case the tibia has the possibility to rotate on its longitudinal axis, given the lower congruence between the surfaces of the condyles of the femur compared to the condyles of the tibia. In fact, given the shape of these articular surfaces, they will have their maximum contact ratio in the lase of extension (fig. C1-2).

A greater congruence ratio, useful for the safety and solidity of the joint, is however ensured by the presence of two fibrocartilaginous elements or "joint pads", called menisci (plate I, lesson 11).

The medial and lateral meniscus are placed on the respective tibial condyles; their C-shapes trace the perimeter forming a thicker ring on the outside, so as to widen the concavity of the tibial surfaces and thus compensate for the disparity of connection between the articular parts of the femur - curved - and that tibia-almost flat - making them more congruent. Given the ability of the menisci to collapse under the action of pressure, in the erect position, when the thrust is greater, they adapt and keep the articular surfaces in close contact. the menisci are attached to the tibia by ligaments; these allow them a certain degree of mobility, most evident in the meniscus lateral, which is highlighted in movement of rotation of the tibia. In fact, the degree of internal rotation and min hours with respect to external, with an overall angular value between 45 ° and 60 °, movement perceptible thanks to visible displacement under the skin of the fibula head.

This joint system is completed by the following elements: fibrous capsule, ligaments deep (anterior and posterior cruciate transverse of the menisci) and more superficial (oblique and arched popliteal ligament), patellar ligament and tibial collateral

ligaments and fibular. It is content within a joint capsule fibrous. This wraps completely the moving parts and and reinforced by a dense web of ligaments, which partially encompasses also the patella. Inside the capsule, a complex system of horse and synovial folds will retain the joint constantly lubricated by the synovial fluid.

The ligaments also belong to this complex joint system, of which only those affecting the form in a more "superficial" way will be treated, that is tibial and fibular collateral joint (plate I, lesson 11), as well as patellar joint, already treated in the previous lesson.

These two strong ligaments originate from the respective epicondyles: the first inserts itself on the medial condyle and on the medial aspect of the tibia, the second on the head of the fibula. Together with the Crusaders, they hold back in report the two articular parts guiding them in the movement according to an axis directional of flexion ed extension, being illegality in the maximum voltage in the extension. Instead, there is a light relaxation in flexion; in fact the movement of rotation and can only be performed in flexion, since the surfaces articular of the femur, in the gold spiral-like profile, the distance between the epicondyle decreases (origin of ligament) and the points of insertion of the ligament itself (table II, fig. A). In table II we can note, in the two lateral profiles (fig. B) and medial (fig. C), The excursion of the movement of flexion with angle of about 130 °. This movement is limited by approach of the posterior muscle parts own of the form.

Fig. A
Knee flexion right.

1. front view
2. medial profile

Fig. B
Volumetric view of the knee right.

1. anterolateral profile

2. Posterior-medial profile

Fig. C

Knee joint elements seen as primary volumes.

1-2. extension

3-4. flexion

Fig D

Extension e flexion of knee right.

Table II

Fig. A

Movement from extension to flexion of the right knee in lateral view. We note the change in tension of the collateral ligament fibular and positioning of the patella in contact with the articular surfaces. Connection patellar, given his conformation, works like a rope flexible that always keeps at the same distance the patella from the tuberosity of the tibia.

Fig. B-C

Articular movement range of the lower limb from extension to flexion of about 130 ° seen in profile lateral (B) e medial (C).

Fig. A

Anterior medial view of the right lower limb with extension and flexion of the leg.

Fig. B

Posterior lateral view of the right limb with flexion of the thigh.

Fig. C

Posterior lateral view in maximum flexion of the left limb.

Fig. D

Anterior lateral view in flexion of the left limb.

Fig. E

Posterior lateral view in flexion of the left limb.

Lesson 13

THE FOOT

The foot segment (Plate I) is the terminal part of the lower limb and the entire weight of the body rests on it. This finds in foot position, orthogonal alia leg, one support surface especially functional thanks, from a side, to the characteristic shape arched foot same, that rests on three points, one rear on calcaneus (fig. A1) and two front respectively on the head of the I. (fig. A2) and V (fig. A3) metatarsal; is on the other to the skeletal structure, consisting of twenty six bones, which guarantees the drain gradual of weight up to soil and the elasticity necessary to locomotion. In fact, the arrangement of the trabeculae of the intrinsic structure of the bone (fig. B) allows the foot to effectively resist the forces of compression together with action of ligaments and tendons of the muscles that contribute to the solidity of the whole. Analyzing in detail of the skeletal structure of the foot (figs. C sgg.), we note that it is consisting of three segments: the tarsus, metatarsus and phalanges, for a total of twenty-six bones including seven short and nineteen long.

Table I

Fig. A

View of the foot from above with the unloading trajectories highlighted of weight.

1. calcaneus
2. head of the first metatarsal
3. head of the V metatarsal
4. trochlea of the talus

Fig. B

Foot skeleton in longitudinal section. Figure schematic of the structure spongy bone the whose weight discharge lines they go

from the trade a of the astragalus at the I metatarsal and at the heel.

Fig. C

Skeleton of the right foot.

Dorsal view.

Tarsus:

a. astragalus

c. heel

s. scaphoid

cu. cuboid

I c. first cuneiforme

II c. according to cuneiforme

III c. third cuneiforme

Metatarsus:

The metatarsals

II metatarsal

III metatarsal

N metatarsal

V metatarsal

Phalanges:

I proximal phalanx

II phalanx median

III distal phalanx

Fig D.

Plantar vision.

Fig.E

View of the medial profile.

Fig.F

View of the lateral profile.

Fig. G.

Front front view.

Fig.H

Front view rear.

The tarsus, formed by the seven short bones and located in the segment past, and the part where major and the Weight load of the body. its elements skeletal are: the talus, the calcaneus, the scaphoid, the cuboid, the first cuneiform, the second cuneiform and the third cuneiform. The metatarsus and formed by five bones long and occupies the segment central of foot and form the connection between the bones of the tarsus and the phalanges. Like all long bones also that of metatarsus they have a base, a body and an anterior head.

The phalanges are fourteen small bones that occupy the most advanced segment and allow the toe joint. Each finger consists of three phalanges, with the exclusion big toe that has two.

To fully understand the shape of the foot in its functional effectiveness, it must be noted how each single element skeletal is aligned on two trajectories that we will call arches. These arches (medial and lateral), submitted to the thrust exerted from the weight of the body, they "follow" its trajectory. The weight that weighs on the joint of the ankle is transmitted to the talus and from this posteriorly to the calcaneus and anteriorly to the rest bones of the tarsus. These in turn branch it out onto the metatarsal bones which, opening up to short fan, they unload the weight in front of the ground.

Medial arch (plate II)

It originates in the calcaneus (fig. A1) which in turn articulates with the talus (fig. A2), the highest point of the arch. From the head of the talus it goes anteriorly into the scaphoid (fig. A3) which communicates with the three cuneiforms (fig. A4) and from these, and in particular from the first cuneiform, passes to the metatarsal (fig. A5), the most expanded and voluminous, up to its articular head.

Lateral Arch

Less elevated, also starts from the calcaneus (fig. B1), but involves the joint with the cuboid (fig. B6) and from this to the V metatarsal (B7) up to its articular head.

In summary, the foot has a medial arch or plantar arch characterized by an accentuated curvature and a lateral arch with a lower and flattened curvature. Furthermore and it should be noted that this difference in height of the two arches and consequently of the two longitudinal margins of the foot, a stranded course in a transverse direction corresponds readable in one section, level of the bones of the tarsus (figs. F-G) as well as in the heads of the metatarsals where the resting on the ground and in the I and V. This layout of the Second arches form longitudinal and transversal ensures that the weight transmission is well distributed over the whole shape.

Table II

Fig. A

Reconstruction in synthetic forms of the skeletal elements that make up the medial arch of the right foot.

1. calcaneus
2. astragalus
3. scaphoid
4. I, II, III cuneiform
5. The metatarsals

Fig. B

Lateral arch of the right foot.

1. calcaneus
2. astragalus
6. cuboid
7. V metatarsal

Fig. C

Volumetric view of the right foot in anterior lateral foreshortening.

Fig D.

Volumetric view of the right foot seen medially. In evidence the medial arch.

Fig. E

Volumetric view of the right foot seen from the side. The arch is in evidence lateral.

Fig.F-G

Volumetric study with section of the right foot at the level of the tarsus.

a. medial arch

b. lateral arch

Lesson 14

THE INDIVIDUAL BONES OF THE TARSUS, METATARSUS AND PHALANGES

The Tarsus

The astragalus

This small skeletal element constitutes, as in architecture, the ideal "keystone", as we have already seen, of the arches of the foot. Together with the bones of the leg, it forms the ankle joint or ankle joint and, precisely for this function, its corp a presents dorsally a raised, semi-cylindrical area, covered by an articular surface for the shaped tibia trochlea (fig. B1). On its sides such area presents two other articular surfaces, the small facet for the medial malleolus (fig. A2) and the facet for the lateral malleolus (fig. C3), fibular, of more extended and triangular shape, with the apex facing downwards.

Being an element that distributes the pressure forces on the whole foot, the talus articulates anteriorly with the scaphoid through a rounded elliptical articular head (fig. B4), connected to the body by a glue (fig. A5). At the bottom, on the other hand, it articulates with the calcaneus through three facets (fig. D), two pastes anteriorly immediately below the head, and one wider and concave below the body, separated from the first two from a deep depression called the sole of the talus (fig. C6).

The calcaneus (The Heel)

It is the largest of the tarsal bones and determines the posterior volume of the foot, and behind the ankle joint. Being thus protruding with respect to the tip of articulation, offers an advantageous lever arm to the triceps muscle of the sura which is inserted with a strong tendon into the calcaneal tuberosity (fig. A7). The body of the heel is massive and prismatic and, given its supporting role and the fulcrum of the arches of the foot, is more expanded posteriorly than anteriorly. In fact, the tuberosity of the calcaneus in the lower part (plantar) expands in two robust

processes, medial (fig. A5) and lateral (fig. C9), which correspond to the subcutaneous surface which unloads the weight of the body on the ground. From these two processes the shape tapers until it ends anteriorly with a small articular extremity (fig. B10) for the cuboid, of quadrilateral shape. In the vicinity of this, in the upper face, we note, in correspondence with the head of the talus, two articular facets and a more extended articular face for the body of the talus. Astragalus and therefore totally supported by the heel.

The scaphoid

It is an interesting element of the foot skeleton because it is the crucial point of the branching process of the forces it is explained by the "fan" shape (fig. H) of the foot itself. It arises in fact between the talus and the cuneiforms and, given the articulation with the elliptical convex head of the talus, its posterior face and particularly hollowed out and concave, whence the name, while the convex front face has three articular facets for the three cuneiform, flat and triangular in shape. The medial face is instead characterized by a tuberosity (fig. E11), place of insertion of the tendon of the posterior tibial muscle.

The cuneiforms

They owe their name to laurel, an aspect that resembles a wedge, with the more tapered part in the plantar direction. Together they form joined to the cuboid, the transverse arch of the foot (figs. E-F G-H). The first is certainly the most robust and largest, given its articular-anterior relationship with the I meta tarsal. II Second and the most small of the three and the vertex of the transverse arch.

The third, of medium size, spreads slightly forward, thus creating a joint joint together with the second and the first cuneiform containment for the II meta tarsal (fig. H), which is the longest of the five metatarsals and the most prominent tip of the longitudinal arch of the foot.

The cuboid

Prismatic in shape, similar to a cube, the cuboid is placed between the calcaneus and the IV and V meta tarsal bones, with which it

articulates. A sulcus can be observed in its external margin (fig. G12), in which the tendon of the peroneus longus runs.

We remember, before moving on to the analysis of the metatarsals, that the joint relationships between these skeletal forms - cuboid, cuneiform, scaphoid - occur on flat or slightly curved articular surfaces, which allow sliding movements, even if contained mortar, given a dense weave of ligaments that hold the individual skeletal elements in contact.

The Metatarsus

It consists of five long bones. All have a base (fig. H13), one head (fig. H14) and a body (fig. H15) with dorsal convexity and sound arranged in a fan shape. It has a base with a flat joint area facing the tarsal bones, a prismatic body with a triangular section with the apex towards the plantar side (fig. I), apart from the first metatarsal with an inverse section, and finally a flattened hemispherical head and flat in the medial and lateral sides.

The first metatarsal is the most voluminous, but also the shortest and articulated with the first phalanx of the big toe.

The II is the longest, surpassing the I both in the head and in the base. All the others follow one another in decreasing length. The peculiarity of the 5th metatarsal lies in its base, which has a wrinkled protrusion, called the styloid process (fig. H16), place of insertion of the peroneus brevis muscle.

The Phalanges

The first toe, the big toe (fig. L), has only two phalanges; the remaining healthy fingers (fig. M) consist of three phalanges called first phalanx or proximal phalanx, second phalanx or middle and third phalanx or distal. The phalanges also have long bones, equipped with a base, a body and a head.

The base of the first phalanx has a concave face for the joint with the head of the metatarsus; the body is always prismatic with two dorsal faces and one plantar, while the head has an articular face for the second phalanx, in the shape of a trochlea, which it serves to direct the flexion and extension movement of the singular phalanges.

The second phalanx is much shorter and maintains the

characteristics of the first as far as the body and the head are concerned, while the base, articulating with the first phalanx, is modeled on the head of the latter.

Laterza phalanx, also very short, has a horseshoe-shaped bone expansion at the distal end, smooth in the dorsal part that corresponds to the nail, and wrinkled in the plantar part, in support of the fingertip.

Obviously the first toe is the most voluminous, the second can sometimes be longer than the big toe while the others follow one another in decreasing length.

Table I

Fig. A

Talus and calcaneus of the right foot. Profile mediate.

- a. astragalus
- c. heel
- 2. articular facet for the medial malleolus of the tibia
- 5. neck of the talus
- 7. calcaneal tuberosity
- 8. medial process

Fig. B

Astragalus and
heel. Front front view.

- 1. trochlea of the talus
- 4. articular head for the scaphoid
- 10. articulate face for the cuboid

Fig. C.

Talus and calcaneus. Side profile.

- 3. joint facet for the lateral malleolus
- 6. so leo of the talus
- 9. lateral process

Fig D.

Talus and calcaneus. Articular facets.

Fig. E

Scaphoid and cuneiform. View of the medial profile.

11. hypertrophy of the scaphoid

Fig. F

Scaphoid, cuneiform and cuboid.

Front front view.

Fig. G.

Scaphoid, cuneiform and cuboid.

Side profile.

12. sulcus of the cuboid

Fig. H and details Tarsus and metatarsus. Dorsal view.

13. base

14. head

15. body

16. styloid process of the

5 metatarsal

Fig. I

Metatarsus and phalanges. Front front view.

Fig. L

The metatarsal and phalanges of the big toe. Medial vision.

Fig. M.

The metatarsal and phalanges. Side view.

MODULAR RELATIONSHIPS FOR FOOT CONSTRUCTION AND VOLUMETRIC DEVELOPMENTS

The total length of the foot (table I, fig. A) is given by the sum of $1T + 1/6T$, which we will call P. In a division into two parts of the P segment, the posterior half corresponds to the tarsus and the anterior half to metatarsal and phalanges. Segment P, further subdivided into three parts, will identify point (a) in the first subdivision ($1/3 P$); from this point, with a height of $1/4 P$, we will maximum the height of the tarsus.

This last segment ($1/4 P$), if rotated with the center in (a), determines anteriorly the tip (b), corresponding to the head of the fifth metatarsal. and posteriorly the tip (c), the medial process of the tuberosity of the calcaneus. To these data we can add that of the diarnetro of the circumference approximate to the dimension of $1/6 P$, with center in (d), which corresponds to the articular surface of the talus (fig. A1). We can also calculate for the size of the phalanges $1/4 P$.

By deducing from the previous analyzes a "schematic" shape that summarizes the structural and morphological contents of the foot, we will notice:

- the medial margin (figs. A, A1, A11) particularly arched, which rises rapidly from the heel and decreases on the head of the I meta tarsal;
- the lateral margin (figs. B, B1, B11), less elevated than the previous one, which extends from the heel to the head of the fifth metatarsal and continues anteriorly, parallel to the ground on the thickness of the fifth toe;
- the anterior margin (fig. C), with a lowered area seen from above and with the apex in the head of the II meta tarsal and decreasing towards the V; its thickness is greater on the head of the I and decreases up to the V. The same type of margin is found

in the extremities of the fingers;

- the posterior margin (fig. D), voluminous and quadrangular;

- la dorsal face (fig. E), facing upwards, convex in shape and strongly inclined longitudinally, with apex on the tarsus, in the head of the talus;

- the plantar face, turned downwards, markedly concave near the tarsus with the medial margin higher than the lateral margin.

Let's see now how we can move to the epidermal form of the foot. Part of the total volume of the foot is occupied by the skeleton; in an observation of the living model, it will be important to identify the points of emergence of this structure "under the skin". We can thus observe at the level of the ankle the protrusion of the two malleoli with the medial paste in an anterior position with respect to the other (see section fig. F).

In the dorsal aspect, the skeleton is directly under the skin; in this case the raised lines of the tendons of the muscles are evident: anterior tibialis (fig. F1), long extensor of the big toe (fig. F2), long extensor of the fingers with its four tendons (fig. F3), peroneal anterior (fig. F4). Below these we note the more modest relief of the extensor brevis muscle of the big toe (fig. Fa) and of the short muscle of the fingers with its three tendons (fig. F b, c, d).

In the region of the fingers, where the extensor muscles have insertion, the skeleton is evident in the dorsal surface near the articulation of the first with the second phalanx.

In the posterior aspect the calcaneus is also evident and we note the relief of the Achilles tendon.

However, while the skeleton is subcutaneous in these points, it is not in the plantar face. In the concave plantar space there is a series of muscles, the function of which is generally that of flexing, an action that contrasts with the movement of extension of the inuscles which have insertion into the dorsal aspect of the foot; to these is added plantar aponeurosis, a thick and rigid system of longitudinal bundles and transverse fibres which, together with the adipose tissue, form a cushion that acts as a

shock absorber between the weight of the body and the ground. This element thus confers, together with the skeletal structure, elasticity plantar support both in support and propulsion of the step.

Finally, in the plantar plane, a short muscle must be considered which also affects the perception of the plastic relief of the shape in the lateral view, that is the abductor of the little finger (fig. H1) which, filling the skeletal concavity at the level of the tarsus and of the metatarsus, gives the relief and the support to the ground of the margin side of the pied e. Just think of the footprint, with its characteristic shape, very marked at the level of the heel and along the entire lateral margin, with the anterior imprint of the heads of the metatarsals and toes.

Fig.A, A1, A11

Modular relationships of the right foot seen in the medial profile. $P = 1T + 1/6T$ - overall measurement of foot length.

to. centre of rotation of the $1/4P$ segment equal to the maximum height of the tarsus

b. head of the V meta tarsal

c. medial process of the tuberosity of the calcaneus

Fig. A1

d. centre of the circumference with a diameter of $1/6 T$ that defines la articular surface of the talus.

Fig. B, B1, B11

Side profile.

Fig. C.

Front front view.

Fig D.
Front rear view.

Fig. E
Dorsal face.

Fig. F
Dorsal aspect and tendon relief of the foot, sectioned at the height of the ankle joint.

1. Tibialis anterior
2. long extensor of the big toe
3. long extensor of the fingers
4. anterior peroneal
5. peroneal long
6. short peroneal
7. calcaneal tendon
8. long flexor of the big toe
9. long flexor of the fingers
10. posterior tibialis

Fig. H
Lateral view of the right foot through a scan of relief lines.

1. abductor of the little finger

Fig.I
Medial view of the right foot.
In evidence the plantar excavation.

Finally, in the plantar plane, a short muscle must be considered that also affects the perception of the plastic relief of the shape in the lateral view, that is the abductor of the little finger (fig. H1) which, filling the skeletal concavity at the level of the tarsus and metatarsus , gives the relief and the support on the ground of the lateral edge of the foot. Just think of the footprint, with its characteristic shape, very marked at the level of the heel and along the entire lateral margin, with the anterior imprint of the heads of

the metatarsals and toes.

If we now observe the foot in the foreshortening in a volumetric and transparent reading of the shape that summarizes the data collected previously, we note that the section in the tip connecting the tarsus and metatarsus (plate II figs. A-B-C), encloses the heights in its thickness. margins, allowing us to identify the plastic shape of the foot, as the aforementioned figures show us in sequence.

A NKLE JOINT, OR TIBIO-TARSAL, AND FOOT MOVEMENTS

The tibio-tarsal joint is composed of the lower part of the tibia, with its articular face for the trochlea and its malleolus, the fibular malleolus and the articular apparatus of the talus. This joint is an angular ginglimo diarthrosis that generates two dynamic situations in the foot: flexion and extension.

By flexion we mean the approach of its dorsal face to the sign of the leg; by extension, the opposite movement. We can thus approximate a flexion angle of 25° and an extension of 35° , which can be calculated from the longitudinal axis of the leg (table I, fig. A).

Another type of movement allowed by this joint is rotation, which involves abduction and adduction movements of the foot, which ideally take place along the longitudinal axis of the foot itself. These rotational movements are more broadly and less constrained at the level of the joint between the calcaneus, the talus and the scaphoid than on the ankle joint, constrained and limited to its sides by the malleolus. The abduction movement leads to the lifting (with the foot off the ground) of the lateral margin of the foot, while the adduction movement leads to the lifting of the medial margin. The first has a minor excursion, given the presence of the fibular malleolus which limits movement while strengthening the stability of the joint. The second is wider, thanks to the reduced size of the tibial malleolus.

Table I

Fig. A

Foot. Medial view.

Flexion and extension movements.

1. bending angle 25°

2. extension angle 35°

3. longitudinal axis of the leg

Fig. B

Foot. Side view.

Example of the hinged mechanism of the metatarsal heads in the propulsion movement (digitograph support)

Figs. A-B

The step sequence:

right foot. Side view, the trajectories that cross the structure of the foot in space are highlighted.

1. digitigraph support: propulsion phase.

2. plantigrade support: support phase.

The foot performs the function of support, but it is also a powerful lever for the movement of man in walking, running and jumping.

The mechanics of walking, in this context analyzed only in the dynamism of the foot, manifests an interesting rhythmic graduality that we can grasp by analyzing the two phases that compose it: the support phase and the propulsion phase (fig. B).

While walking, the foot moves forward until the heel, in this case called plantigrade support, touches the ground; from this initial support the foot comes into gradual contact, along the lateral margin up to the heads of the metatarsals, with the ground, bringing itself into the maximum condition of adherence. From this point the propulsion phase begins, through the lifting of the heel with a thrust point or fulcrum supported by the head of the first metatarsal and by the big toe which thus constitute the digital support, ie on the toes.

The sequence of the step (plate II) is therefore constituted by a cyclic movement that goes from the plantigrade support to the digitigrade support, alternating in the two limbs.

Lesson 17

THE LOWER SKELETAL LIMB: JOINT MOVEMENTS

As we have already seen, there are three joints that concern the lower limb segment: the hip, knee and ankle joint.

HIP JOINT

It occurs in the acetabulum of the pelvis with the head of the femur. It is a highly mobile osteoarthritis that has a hemispherical concavity containing a spherical shape.

This joint allows five types of movement:

- 1 rotation on its own axis
- 2 extension
- 3 flexion
- 4 adduction
- 5 abduction.

Furthermore, through the sum of the last four movements we have the circling, a movement that generates a conical figure in the space with apex in the acetabulum in the center of the femur and base on the knee. In the example (table I, figs. A-B C), we can see how, with a fixed point on the hip, we can see can cause flexion of the thigh on the trunk (fig. A1).

KNEE JOINT

It occurs between the femur and the tibia. And an angular ginglimo diarthrosis. The two condyles of the femur rest as rollers on a horizontal base that is given by the condyles of the tibia creating two main movements, one of extension and the other of flexion. Thus, with a fixed point on the condyles of the fern ore, flexion of the leg on the thigh is obtained (fig. A2) with various angular degrees up to a maximum of about 150°, flexion movement limited by the approaching of the muscular masses. It should be noted that the patella, in the three phases described, follows the movement of the tibia to which it is connected by the patellar

ligament.

ANKLE JOINT

Composed of the articular mortar tibio fibulare and the talus, this joint is also an angular ginglimo diarthrosis. It generates two main movements in the foot, one of dorsal flexion (fig. A3) and the other of extension, also called plantar flexion (fig. A4).

Table I

Fig. A

Lower limb seen in lateral profile from stasis to dynamics.

1. flexion of the thigh on the trunk
2. flexion of the leg on the thigh
3. dorsal flexion of the foot on the leg
4. extension of the foot on the leg

Fig. B

Front front view.

Fig. C.

Front rear view.

Lesson 18

MUSCLES OF THE LOWER LIMB: MUSCLES OF THE HIP

It is a mantle of muscles that originate from the external and internal part of the wing of the ilium, covering it and which are inserted into the superior portion of the femur.

They are short and particularly robust muscles, and given the small distance that separates their origin from the insertion, they develop in large and massive surfaces, thus allowing them to perform an effective movement action. They play a generic role of abductor of the thigh and extensors of the lower limb (Table I, figs. A1-2 -3). They are divided into:

internal iliaks:

grande psoas (g.p.), iliac (i)

external iliaks:

gluteus maximus (1), gluteus medius (2), gluteus minimus (3), piriformis *, fascia lata tensor (4), internal obturator *, external obturator *, upper twin *, lower twin *, square of the femur *

* They are excluded from the analytical and graphic description as they are deep and hidden from the most superficial muscles.

Large psoas (plate I, fig. B g.p.)

Origin: from the lateral surface of the vertebral bodies of the XII thoracic vertebrae and those from the I to the IV lumbar vertebrae, from the intervertebral discs and from the transverse processes from the I to the V lumbar vertebrae.

Insertion: Fuses with the iliac muscle in the lesser trochanter of the femur.

Function: flexes the thigh on the pelvis.

iliacus (plate I fig. B i.)

Origin: iliac fossa.

Insertion: Together with the greater psoas, on the lesser trochanter of the femur. In the lower extremity both pass under the inguinal ligament.

Function: flexes the thigh on the pelvis.

inguinal ligament (table I fig. B l.i.)

The ligament joins the tubercle of the pubis and moves to the anterior superior iliac spine. It thus contributes to the formation of the upper femoral arch, a sort of half ring that divides the root of the thigh from the abdomen.

Table I

Fig. A

Movements of the lower limb.

1. abduction movement of the lower limb
2. extension movement of the lower limb
3. flexion movement of the lower limb

Fig. B

Anterior view of the deep muscles of the hip.

g. p. great psoas

i. iliac

l.i. inguinal ligament

7. rectus femoris

11. tailoring

12. pettineo

gluteus maximus (Table I figs. C-D1)

It is the strongest and most voluminous muscle of the hip muscles and determines the relief of the buttock. A superficial portion can be distinguished (fig. E1a) which determines the upper and lateral part of the muscle. The latter, near the greater trochanter, ends with a thick tendon aponeurosis which, passing laterally to the trochanter itself, merges with the ilio-tibial tract (fig. E5) of the tensor fascia lata muscle (fig. E-D4), creating a texture of tendon bands. The deepest and most voluminous part (Fig. E1b) moves posteriorly to the greater trochanter in the tuberosita glutea, near the vastus lateralis muscle of the quadriceps (Fig. D9).

Origin (fig. E1a, 1b): from the last posterior part of the crest and the external iliac face, behind the posterior gluteal line, from the lateral margin of the sacrum and coccyx and finally from the sacro tuberos ligament (fig. F).

Insertion (fig. E1a, 1b): In the tuberosita glutea of the femur, under the greater trochanter (fig. F).

Function: it is the fundamental muscle for standing. It erects the pelvis and consequently the trunk on the femurs. Extends the thigh over the hips carrying the limb posteriorly and laterally (abduction movement).

Gluteus medius (Table I, fig. D2)

Triangular in shape, placed on the lateral wall of the pelvis (Fig. F). There are two portions of muscle bundles, one anterior and one posterior.

Origin (fig. E2): In the external area of the wing of the ileum bounded by the anterior and posterior gluteal lines (fig.G).

Insertion (Fig.E2): Superior tip of the greater trochanter (Fig.F).

Function: abducts the thigh. If the point is fixed and on the femurs, the gluteus medias determine the oscillation of the pelvis, evident

in the gait of the step.

Gluteus minus (Plate I, figs. E-G3)

Placed below the gluteus medius, being smaller in size, and totally hidden by it.

Origin (fig.E3): External face of the ileum between the anterior and inferior gluteal lines (fig. G).

Insertion: Summit of the greater trochanter.

Function: abducts the thigh together with the gluteus medius.

Tav. I

Fig. C

Lateral view of the plastic relief of the muscular system of the lower limb.

Fig. F

Posterior-lateral view of the right hip.

s. sacrum

c. coccyx

l.s.t. tuberos sacred ligament

1. gluteus maximus-

origin, insertion and volumetric trajectory of the last

t.g. tuberosita glutea del femore

2. medio buttock

Fig. G

Posterior-lateral view of the right hip.

l.g. post. posterior gluteal line of the ileum

l.g.ant. anterior gluteal line of the ileum

2 or. area of origin of the gluteus medius

3. gluteus lesser

Tensor fascia lata (Table I figs. D-E)

It is divided into two segments: tensor muscle (4) and the long tendon of the fascia lata called iliotibial tract (5). that muscle is located laterally and anteriorly between the wing of the ileum and the greater trochanter. In shape it is elongated and flattened. The fascia lata is a fibrous membrane which lines la longitudinally laterally thigh muscle mass. This lining along the side lateral of the thigh, in correspondence of the vastus lateral muscle, it thickens creating a strong tendon blade called the iliotibial tract (5) which, originating in the vicinity of the greater trochanter, in continuity with the superficial fibers of the gluteus maximus (1a), it is inserted with a tendon into the lateral condyle of the tibia. This tendon blade, kept in constant tension by its muscular tract, laterally contains and guides the powerful muscle masses of the quadriceps, making it more controlled and effective movement.

Origin: Lateral on the anterior superior iliac spine

Insertion: on the lateral condyle of the tibia.

Function: abducts the entire lower limb, being connected to the tibia. Flexes thigh over pelvis.

Mostly the hip muscles analyzed and described up to now have a dual function: to support the pelvis on the femurs and to determine abduction of the lower limb.

Fig. D-E

Muscular apparatus of the lower limb in lateral view. Muscle origin, insertion and trajectories.

Muscles of the hip.

1. gluteus maximus: superficial portion 1a deep and posterior

portion 1b

2. gluteus medius
3. gluteus lesser
4. fascia lata tensor
5. iliotibial tract of the tensor fascia lata muscle

Anterolateral muscles of the leg.

Quadriceps:

6. Patellar ligament
7. rectus femoris
8. vastus medialis
9. vastus lateral
10. vast intermediate
11. tailoring

Hamstrings.

18. semimembranous
19. biceps-long head
20. biceps - short head

Front leg muscles.

21. Tibialis anterior
22. long extensor of the fingers
23. long extensor of the big toe
- l.t. transverse ligament
- l.c. cruciate ligament

Lateral leg muscles.

24. peroneus longus
25. peroneus brevis

Back muscles of the leg.

Triceps:

26. Achilles tendon
28. gastrocnemius - lateral head

29. soleus

Lesson 19

MUSCLES OF THE LOWER LIMB: MUSCLES OF THE THIGH

They are divided into three groups: antero-lateral, medial, posterior.

ANTERO-LATERAL MUSCLES OF THE THIGH

These muscles, which are carried as an insertion on the skeleton of the leg, originate both from the skeleton of the pelvis and from the skeleton of the femur. Their action consequently develops on both the hip joint and the knee joint. Their function is therefore of flexors of the thigh on the pelvis and of leg extensors on the thigh (Plate I, fig. A1-3).

They consist of the quadriceps femoris group and the tailoring. The quadriceps femoris and the most voluminous muscle of the thigh. It consists of the following four muscular bodies (table I, figs. B-C-D-E):

- rectus femur 7
- vastus medialis or internal 8
- vastus lateral or external 9
- vast intermediate 10

It has two origins:

one on the skeleton of the pelvis with the rectus muscle of the femur (fig. B7) and the other on the skeleton of the femur, with the "vast" muscles (fig. B8-9). These create with their muscle mass a large part of the plastic volume of the thigh; in fact they almost completely cover the shaft of the femur, leaving only the posteriorly uncovered harsh line (see section fig. B). All these muscles have a common insertion in the upper margin of the patella through the patellar tendon and through the patellar ligament (Fig. B6) into the tuberosity of the tibia.

Rectus femur (Table 1 figs. D-E7)

It is a long muscle placed anteriorly on the midline that proceeds

from the knee to the anterior inferior iliac spine. It has a tapered shape that is wider on the upper half of the thigh.

Origin: rises with the tendon head from the iliac spine front inferior (fig. E7).

Insertion: The muscular body is transformed well above the patella in a ribbon-like tendon entering the upper margin of the patella (fig. E7).

Medial vastus (Table I, figs. D-E8)

Arranged along the medial ilium of the femur, it exhibits maximum dilatation plastic at the bottom, just above the kneecap.

Origin: under the lesser trochanter (fig. E8), from the medial margin of the harsh line.

Insertion: with a short tendon lamina it leads to the tendon quadriceps joint on the mediate and superior margin of the patella (fig. E8).

Vasto lateral (table I, figs. D-E9)

It has a very large surface both laterally and posteriorly.

Origin: from the intertrochanteric line, from the gluteal tuberosity of the femur and from the lateral margin of the sour line (fig. E9).

Insertion: by means of a tendon lamina it is inserted into the tendon quadriceps joint on the lateral and upper edge of the patella (fig. E9).

Table I

Fig. A

Movements of the lower limb.

1. flexion movement of the thigh on the pelvis
2. extension movement of the lower limb
3. flexion movement of the lower limb

4. adduction movement of the lower limb

Fig. B

Anterior view of the quadriceps muscle group of the leg.

- 6. Patellar ligament
- 7. rectus femur
- 8. vastus medialis
- 9. vastus lateral
- 10. vast intermediate (see section)
- sp.i. iliac spine lower front
- t.r. patellar tendon
- r. patella
- t.t. tuberosity of the tibia
- l.a. sour line (see section)

Fig. C

Anterior front view of the plastic relief of the apparatus muscle of the lower limb; skeletal layouts and perimeters muscular.

Fig. D-E

Muscular apparatus of the lower limb in the front view front.

Muscle origin, insertion and trajectory.

Hip muscles:

- 1. inguinal ligament
- 2. gluteus medius
- 3. gluteus lesser
- 4. fascia lata tensor
- 5. iliotibial tract of the tensor muscle of the fascia lata Anterior lateral muscles of the leg.

Quadriceps:

- 6. Patellar ligament
- 7. right of femur
- 8. vastus medialis
- 9. vastus lateral
- 10. vast intermediate

11. tailoring

Medial thigh muscles.

12. pettineo

13. adductor brevis

14. long adductor

15. great adductor:

a. lateral portion

b. medial portion

16. Gracilis

Hamstrings.

17. semitendinosus

19. biceps-head

long Front leg muscles.

21. Tibialis anterior

22. long extensor of the fingers

23. long extensor of the big toe

l.t. transverse ligament

l.c. cruciate ligament

Lateral leg muscles.

24. peroneus longus

25. peroneus brevis

Posterior muscles of the leg. Triceps:

27. gastrocnemius - medial head

28. gastrocnemius - lateral head

29. soleus

Vasto intermediate (Table I, fig. E10)

It is interposed between the rectus femoris and the anterior aspect of the femur. Turns out hidden, being placed between the vast lateral, the vast mediate and the rectus femoris (section Fig. B10).

Origin: on the anterior and lateral aspect of the femur (fig. E10).

Insertion: merges into a tendon lamina with the other leaders,

slightly above the patella and behind it (fig. E10).

Function generated: the quadriceps and leg extensor on the thigh given the insertion on the tuberosita of the tibia. The rectus femoris, finding its origin in the pelvis, can lift your thigh, flexing it on the dome. In the standing position it plays an inactive role; the rectum can however simultaneously extend The leg on the thigh and flex the latter on the pelvis.

Sartorio (plate I, figs. D-E11)

It is a ribbon-like muscle and is the longest muscle of the human body. Crosses the entire thigh diagonally from top to bottom, from outside to inside. It arises with its trajectory between the expanded volume area of the vastus mediate and the triangular-shaped area, better known as the femoral triangle (*) occupied by the muscles adductors (fig. C). The two areas are thus highlighted by the course of the muscle, which therefore becomes an important signal in the reading of the living model.

Origin: arises from the anterior superior iliac spine (fig. E11).

Insertion: crossing the mediate and posterior margin of the condyles of the knee, inserts under the medial condyle of the tibia in a tendon insertion area called "goose paw", given the shape of three embossed digits, which expand like a fan on the skeletal surface (see also table II, fig. B), slightly above of the muscle gracilis and the tendon of the sernitendinosus muscle.

Function: being very long, its action and weak. It collaborates with other muscles in flexing the leg on the thigh and in the internal rotation of the leg (movement that occurs along the mechanical axis of the lower limb).

(*) for the femoral triangle, see the medial muscles of the thigh.

MEDIAL MUSCLES OF THE THIGH

This muscle group (table I, figs. C-D-E) connects the part inferior of the pelvis, pubic and ischial branch, to the femur, where four of its

elements find insertion in the lip mediated by the harsh line, thus affecting their movement on the hip joint. As we'll see, only the gracilis muscle, that finds adhesion on skeleton of the leg, involves the knee joint thus connecting the pelvis to the tibia. These muscles thus occupy the large area triangular delineated laterally by the inclined course of the shaft of the femur, which is called a triangle femoral (fig. C). This area is limited at the top by the inguinal ligament, medially, near the median axis by the body of the gracilis muscle and laterally by the sartorius muscle.

The action of the medial muscles is mainly that of adduction of the thigh, and they oppose the abduction movement carried out by the hip muscles.

They are divided into: pectineus (12), short adductor (13), long adductor (14), large adductor (15), and puny (16).

Pectineus (plate I, figs. D-E12)

It is placed obliquely from top to bottom, from the superior pubic branch to the femur.

Origin: from the pectinea eminence to the tubercle of the pubic branch upper (fig. E12).

Insertion: posteriorly, on the branch of the linea aspera leading to the lesser trochanter (Fig. E12).

Function: adducts and flexes the thigh.

Short adductor (Table I, figs. D-E13)

Triangular in shape, and the lesser of the three adductors. In the anterior view (fig. D) it is further back than the pectineus and the adductor long.

Origin: from the lower branch of the pubis (fig. E13).

Insertion: medial margin of the spiral line in the upper third (fig. E13).

Function: adducts the femur and makes it rotate outward.

Long adductor (Table I, figs. D-E14)

Triangular in shape, and the adductor muscle best visible anteriorly, being placed in front of the large adductor. Complete the space that goes from the short adductor to the gracilis (fig. D).
Origin: from the lower branch of the pubis near the pubic tubercle.
Insertion: Medial margin of the linea aspera, in the middle third.
Function: also adducts the thigh by rotating it towards the outside.

Great adductor (Table I, figs. D-E15)

It is the largest and most powerful of the adductors. In the anterior front view it is placed behind the muscles mentioned above and stands out in two portions:
The first, of wide and triangular shape (fig. D15a), the second of elongated and fusiform shape (fig. D15b).

Origin: in small part from the inferior branch of the pubis and in the totality from the inferior branch of the ischium up to the ischial tuberosity.

Insertion: The first portion (fig. E15a) finds a broad line of insertion over the entire medial margin of the linea aspera e it continues on most of the medial margin of the plane popliteal; the second portion (fig. E15b), formed largely by the bundles that originate near the tuberosity ischial, it fits with a sturdy tendon cylindrical above the medial condyle of the femur. This long line of insertion e interrupted by a orifice, where the vessels of the thigh pass (for a better comprehension of the muscle form in question see also pl. I, fig. F, lesson 20).

Function: being the most powerful of the adductors, it can tighten strongly the thighs until crossing them.

Fig. A

Medial view of the limb lower: plastic relief of the muscular system.

Figs. B-C

Muscles of the lower limb in the medial view.

Origin, insertion and trajectories muscular.

Hip muscles:

1. gluteus maximus

Anterolateral thigh muscles.

Quadriceps:

6. Patellar ligament

7. rectus femur

8. vastus medialis

9. vastus lateral

10. vast intermediate

11. tailoring

Medial thigh muscles.

13. adductor short

14. long adductor

15. great adductor:

a. lateral portion

b. medial portion

16. puny

Posterior muscles of the leg.

17. semitendinosus

18. semimembranous

Front leg muscles

21. Tibialis anterior

23. long extensor of the big toe

Lateral muscles of the leg

24. peroneal long (portion tendon)

Posterior muscles of the leg

Triceps:

26. tendon of Achilles

27. medial gastrocnemius-head

29. soleus

Gracilis (plate I, figs. D-E16)

It is a thin, ribbon-like muscle. It defines with its own trajectory perpendicular to the medial margin of the thigh (fig. D16).

Origin: from the inferior pubic branch near the pubic symphysis (fig. E16).

Insertion: slightly below the medial condyle of the tibia. It helps to form the tendon insertion area called "goose paw"; it is thus brought into position central tendon trail of the tailoring and that of semitendinosus (fig. E16 and table II, figs. A-B-C).

Function: adduction of the lower limb. Contributes to flexion of the knee and can also rotate the leg inwards.

Tav. III

Fig. A

Anterolateral view of the left lower limb. Study of muscle relief in relation to the structure of the skeleton.

Fig. B

Anterior lateral view. Study of the epidermal relief.

Fig. C.

Medial antero view of the pelvis, femur, tibia, right limb segments and quadriceps muscle relief.

Fig. D

Anterior medial view in knee flexion right.

Fig. E

Anterior lateral view of the detail of the right lower limb seen in the study of the muscular forms, in the plastic relief in relation to the structure skeletal.

1. gluteus maximus
2. gluteus medius
4. fascia lata tensor
5. Tendon tract of the tensor fascia lata muscle

- g.t. greater trochanter
6-7-8-9. group quadriceps
11. tailoring
g.m. medial muscle group
19. biceps - long head
21. Tibialis anterior
22. long extensor of the fingers
24. peroneus lunge
28. lateral gastrocnemius-head
29. soleus
-

Lesson 20

MUSCLES OF THE LOWER LIMB: POSTERIOR MUSCLES OF THE THIGH

These muscles (Table I, figs. A-B), which together form the posterior plastic volume of the thigh, originate from roughness of the tuberosity ischial pelvis and fit on two skeletal parts of the leg, tibia and fibula (fig. B), involving the hip and thigh joint in their action knee.

This sturdy muscle mass is made up of three spindle-shaped muscles which in the lower extremity of the thigh taper off and branch out into two pillars, the medial and illateral, thus highlighting a hollow space, called the "popliteal fossa". In this area the medial margin and composed of semimembranous muscles and semitendinosus, while the lateral margin and consists of the sturdy tendon pillar of the biceps (figs. A B). On the skin space popliteal triangular is convex in extension of the lower joint (fig. A) and concave in flexion (fig. C).

The action of these muscles is to flex the leg and to extend the pelvis on the thigh, taking a fixed point on the leg and thus contributing to the function of bringing the trunk upright on the lower limbs. Give these two functions, they result from consequence antagonists of the anterior muscles (fig. E).

The posterior muscles are divided into semitendinosus (17), semimembranous (18), biceps-long head (19) and short head (20)

Semitendinosus (Table I, figs. F-G17)

It has an elongated and fusiform shape and is placed on the medial side of the thigh. In the upper two thirds and muscular body, in the last lower third it has a thin tendon.

Origin: tuberosity ischial (fig. G).

Insertion: under the medial condyle of the tibia; it goes to insert itself in the "goose paw", where they already are welcomed the tailor and the gracilis (fig. G).

Function: flexes the leg on the thigh and only in this case it can also act as a medial rotator of the leg, in synergistic action with the semimembranosum.

Semimembraneus (Table I, figs. F G18)

It is placed behind the semitendinosus and unified with it in its origin. It has a dilated and flattened shape. In its lower part, especially in the more spread lateral margin, near the popliteal plane, it determines an epidermal eminence visible in the extension of the lower limb.

Origin: ischial tuberosity.

Insertion: on the medial condyle of the tibia.

Function: leg flexion and medial rotation. Extends The thigh on the trunk. With fixed point on the tibia it extends the pelvis on the thigh.

Biceps (Plate I, figs. F-G19,20)

Placed laterally, it is more developed than the semitendinosus. Spindle-shaped and slightly flattened, it has two muscular bodies: the long head (fig. F19) and the short head (fig. F20). Origin: the long head originates on the band posterolateral of the tuberosity ischial adhering to the semitendinosus (fig. G19); the short head originates on the middle third of the lateral margin of the sharp line of the femur (fig. G20).

Insertion: the two heads unify in a single and sturdy tendon which is worn on the head of the fibula.

Function: flexes the leg; extends the thigh over the trunk; extends the pelvis. In the flexion and lateral rotator of the leg. In flexion of the knee right, in the example graph (figs. C-D-D1), we notice how the biceps tendon becomes particularly also visible under the skin and as in the vision posterior (fig. C) both the depression is accentuated of the pit popliteal than the relief of medial muscles.

Table I

Fig. A

Front view posterior of the plastic relief of the apparatus muscular.

p.m. medial pillar

f.p. popliteal face

p.l. lateral pillar

Fig. B

Posterior-lateral view of the muscle group rear of the thigh.

t.i. ischial tuberosity

17. semi-intendinosus

18. they seem to know

19. biceps - long head

t. tibia

t.f. head of the fibula

p.p. popliteal floor

Fig. C.

Flexion of the right knee in posterolateral view.

17. semitendinosus

18. semirnerbranso

Fig D.

Anterior lateral view in knee flexion right.

5. iliotibial tract of the tensor muscle of the fascia lata.

Fig. D1

Anterior view in flexion of the knee right.

6-7-8-9 quadriceps

11. tailoring

19. biceps tendon stretch long head

t.f. fibula head (element emerging under the skin)

Fig. E

Movement of leg flexion on leg.

Fig. F-G

Muscular apparatus of the lower limb in the front view rear.

Origin, insertion and trajectories muscular.

Hip muscles:

1. gluteus maximus
2. gluteus medius
3. gluteus lesser
4. fascia lata tensor
5. iliotibial tract Anterolateral thigh muscles.

Quadriceps:

7. rectus femur
8. vastus medialis
9. vastus lateral

Medial thigh muscles.

12. pettineo
13. adductor brevis
14. adductor long
15. great adductor:
 - a. lateral portion
 - b. medial portion
16. puny

Hamstrings.

17. semitendinosus
18. semimembranous
19. biceps - long head
20. biceps - short head

Lateral muscles e posterior of the leg.

24. Peroneus longus
25. Peroneus brevis

Triceps:

- 26. Achilles tendon
 - 27. gastrocnemius-medial head
 - 28. - lateral head
 - 29. soleus
 - 30. long footbed
-

Lesson 21

LOWER LIMB MUSCLES: ANTERIOR, LATERAL AND POSTERIOR LEG MUSCLES

ANTERIOR MUSCLES

In the leg the forelegs cover the anterior lateral aspect of the tibia (see section table I, fig. B). They are muscles that originating from the tibia and entering the bones of the foot, they act on the movement of the ankle joint; Their generic action is of the dorsal flexors of the foot and extensors of the fingers (table I, fig. A1). In the muscles of the leg the muscular part develops in its greatest expansion in the median region; while starting from the lower third and at the level of the ankle joint, it becomes tendinous. This series of tendons is kept in contact with the skeletal part by the transverse and cruciate ligaments which function as guides, preventing the tendons, in their actions, from moving from their seats and trajectories of movement.

Transverse ligament (see table I, lessons 18 19, l.t.)

Located above the ankle joint, and joined to the margin antero-medial of the tibia and to the lateral margin of the fibula. Determine two conduits for the passage of tendons of the anterior muscles of the leg.

Cruciate ligament (see table I, lessons 18 19, l.e.)

Arranged on the back of the tarsus, it has three Y-shaped ribbons. Two of these are medial, an upper one that connects to the malleolus of the tibia, a lower one that joins the scaphoid of the tarsus. The third is carried laterally on the heel. Form three ducts in the Which the tendons that have already crossed the ligament continue transverse.

The muscles anterior are subdivided into tibialis anterior (21), elite long extender (22), extensor long of the big toe (23).

Tibialis anterior (Plate I, figs. B-C D21)

It is the largest of the previous ones; the muscular body is prismatic and flattened in shape. The tendon begins to manifest from the lower half of the leg (Fig. B).

Origin: from the lateral condyle of the tibia, from the first upper third of the anterior lateral aspect of the tibia and from the interosseous membrane (see also table of lessons 18-19)

Insertion: the tendon, passing under the transverse and cruciate ligament, crosses the dorsum of the foot and reaches the plantar face, at the point of junction of the I cuneiform the I metatarsus (see also table overall lesson 19).

Function: dorsally flexes the foot towards the front of the leg and rotates it medially. In this action the tendon is raised under the skin in short section of the ankle joint.

Long finger extensor (Table I, figs. B-C-D22)

It is elongated and flattened in a semi-pinnate form. Located laterally with respect to the anterior tibial, and partially hidden from it in the end higher. The tendon manifests itself at the beginning of the third lower of leg and is flattened. Moving on below attachment transverse and crusader, branches into five tendons, of which the main four run dorsally up to the four toes, while the fifth can also consider yourself belonging to a distinct muscle called the third peroneal (fig. C, p.t.).

Table I

Fig. A

Foot movements.

1. flexion dorsal
2. plantar flexion
3. abduction

Fig. B

Antero-frontal view of the muscles of the leg.
Section of the muscles and skeleton of the leg.

- t. tibia
- f. fibula
- a. anterior muscles
- l. lateral muscles
- p. posterior muscles

Front muscles:

- 21. Tibialis anterior
- 22. long extensor of the fingers
- 23. extensor Long big toe
- 27. gastrocnemius - medial head
- 28. lateral head

Origin: lateral tibia condyle, head from anterior margin fibula (see also Tav. 18-19).

Insertion: The first four tendons are carried from the 2nd to the 5th finger on the base of the third phalanx. The fifth tendon is carried over the dorsal aspect of the tuberosity of the fifth metatarsus. In detail, the four tendons merge with the tendons of the short extensor of the fingers; at the level of the first phalanx, each tendon branches into three peaks: the medial is fixed at the base of the second phalanx and the two lateral ones at the base of the third phalanx (see also overall table for lessons 18-19).

Function: extends the first four toes, flexes the foot dorsally, bringing it closer to the leg and abducting it. In this movement we note the relief of the tendons under the skin, in particular at the level of the joint between the metatarsal and phalanges.

Long extensor of the big toe (Table I, figs. B-C-023)

It is the shortest and smallest of the forelegs. It features a flattened muscular body which is hidden by the anterior tibialis and by the Jungo extensor of the fingers (fig. B). The tendon is visible just above the ankle joint.

Origin: from the half of the leg, from medial margin of the fibulae from the interosseous membrane (see also overall table lessons 18-19).

Insertion: passing under transverse and cruciate attachment, the tendon moves to the base of the second phalanx of the big toe (see also pl. total lessons 18-19).

Function: extends the big toe and is in synergy with the anterior tibial.

LATERAL MUSCLES OF THE LEG

The lateral muscles almost completely cover the skeleton of the fibula with their mass, with the exception of the malleolus, and are inserted into the bones of the tarsus thanks to two strong tendons that pass through behind the articular pin consisting of the malleolus itself. These muscles therefore act both as plantar flexors to help the powerful posterior flexors and as abductors (Table I, Figs. A2-3). They are divided into peroneus longus (24), peroneus brevis (25).

Fig. C
Lateral view of the leg muscles.

Lateral muscles.
24. peroneus longus
25. peroneus brevis

p.t. peroneal anterior, also called peroneal third

Back muscles. Triceps:

26. Achilles tendon

28. gastrocnemius - lateral head

29. soleus

Peroneus longus (Table I, figs. C D24)

It is a bipennate muscle that covers a large part of the fibula. At the top it is voluminous and flattened at the bottom. It has a long tendon that is outlined on the lateral half of the leg that is brought back to the lateral malleolus, in whose groove it is received and then diagonally crosses the lateral aspect of the calcaneus (Fig. C).

Origin: from the head of the fibula and its lateral margin (see also overall table lesson 18).

Insertion: after crossing the calcaneus laterally, the tendon continues on the sulcus of the cuboid, reaching from the plantar side the junction of the first cuneiform with the 1st metatarsus (see also table overall lesson 18).

Function: abducts and moves the foot laterally and flexes it on the plantar face.

Peroneus brevis (Table I, figs. C-D25)

Located under the peroneus longus covered, but can be seen at the level of the lower third of the leg, where with its tendon tract it joins the tendon of the peroneus longus and continues coupled to the latter up to the lateral malleolus and in the lateral aspect of the calcaneus (fig. C).

Origin: in the middle third of the lateral surface of the fibula (see also overall table, lesson 18).

Insertion: on the tuberosity of the V metatarsus. (see also table overall lesson 18).

Function: abducts and moves the foot laterally.

THE POSTERIOR MUSCLES OF THE LEG

These muscles can be divided into superficial and deep. The former form the expanded volume of the calf of the leg, originate from the skeleton of the femur and tibia and reach the heel of the foot with a strong tendon, called Achilles. Consequently, in their action they act on both the knee joint and the ankle joint.

This set of muscular elements, called the triceps of the sura, has the function of plantar flexor and together with the hamstring and gluteus maximus contributes to the erect position of the man (see table I, fig. A2, lesson 21).

They are divided into triceps of the sura (26-27-28 29), plantar (30).

Triceps of the sura (Table I, figs. A-B)

Consisting of three heads, it is distinguished into three extensive muscle carpi: gastromemius medial head, also called medial twin (27), lateral head gastromemius, called lateral twin (28) and soleus (29), unified below by the Achilles tendon (26). Overall, the triceps characterises the elongated ovoid shape of the calf, where the slightly more medial twin is distinguished. extended of the lateral. The two twins are separated in origin by two short tendons; they join after a short stretch, then dilating in the two muscle carpi (distinct, along the median line, by a slight depression) and finally uniting in the Achilles tendon. Under the twins and located the body of the sole, a muscle of considerable consistency, a little flattened, legible on the sides of the Achilles tendon in the lower third of the leg.

Origin: the two twins arise above the condyles of the femur at the edge of the popliteal plane (see also overall table for lesson 20). The soleus connects to the head and margin posterior and superior of the fibula, as well as to the posterior aspect of the tibia over a large tendon area.

Insertion: the three heads londono in the Achilles tendon which is inserted. and on the tuberosity of the calcaneus (see also table overall lesson 20).

Function: plantar flexion of the foot. Lift the heel by elevating the foot on the ends of the toes. In this action the twins take on such a relief that they can be clearly distinguished under the skin.

Footbed (see lesson 20, figs. F-G30).

It is thin and slender, interposed between the twins and the soleus. It is negligible due to the lack of plastic relevance. Satta the knee turns into a very long tendon.

Origin: above the lateral condyle of the femur, near the lateral twin.

Insertion: The tendon passes along the medial margin adhering to the Achilles tendon.

Function: collaborates with the triceps of the sura.

Fig D.

Anterior lateral view of the muscles of the lower limb.

Fig A.

Posterior front view of the posterior muscles.

p.p. popliteal plane

Triceps:

26. Achilles tendon

27. lateral gastrocnemius-head

28. gastrocnemius-medial head

29. soleus

The deep muscles

They originate from the skeleton of the tibia in the posterior aspect, They pass behind the tibial malleolus and the talus and have an insertion on the skeleton of the foot in the plantar face. Their action is overall that of flexors.

They are divided into popliteal, posterior tibial, long flexor of the fingers, long flexor of the big toe.

These four smaller, healthy muscles hidden by the triceps of the sura e therefore they are not analyzed graphically.

Fig. B

Posterolateral view of the posterior muscles.

Lesson 22

STRUCTURE AND PLASTIC SHAPES OF THE LOWER LIMB: SUMMARY NOTES

Although much of the structure of the skeleton is not emerging under the skin, it is an integral part of the structure of the form as a whole, so in a reconstruction of the plastic relief we must pay attention to those points or nodes where the inside, understood as a skeleton, interacts with the outside. To better understand the muscle volumes and their relationships with the structure skeletal, therefore we summarize the parts in which it skeleton manifests itself under the skin:

- the greater trochanter, the hip-thigh joint that marks the beginning of the segment skeletal of the shaft of the femur;
- the knee joint, mostly covered only by the ligaments and muscle tendons;
- the tibia, which emerges in all its medial face up to the malleolus;
- The head of the fibula and its malleolus;
- The dorsal aspect of the foot;
- the segments of the I and II phalanx of the fingers in the dorsal aspect.

Tav. I

Fig. A-B-C

Study of the foreshortening of the left lower limb in flexion with antero-medial point of view.

Fig. A

Volumetric perimeter of the skeleton in relation to the muscle trajectories.

a. medial margin of the adductors

7. rectus femur

11. tailoring

28. lateral gastrocnemius-head

Fig. B

Definition of the muscle perimeter.

Fig. C.

Plastic survey analysis.

Fig. D-E-F and details.

Study of the behaviour of the plastic volume of the medial and anterolateral muscles in relation to the skeleton in flexion, with a view anterior-medial of the left lower limb.

Fig. D

a. total volume of adductors

12. pettineo

15 b. great adductor tendon

Fig.E

q. quadriceps: overall volume and insertion of the vastus medial, intermediate and lateral muscles on the rotula

7. trajectory of the rectum

Fig. F

7. plastic volume of the rectus femoris

11. tailoring

F (1-2) details: quadriceps and biceps in relation to the left knee in flexion with anterolateral point of view

Fig. G.

Left knee extension seen with foreshortening antero-medial.

Table II

Fig A.

**Reconstruction of the flexion movement of the right lower limb.
Anterolateral view. Particular**

Fig. A1:

11. tailoring

16. puny

17. semitendinosus

z.d. goose leg

Fig. B-C-D-E

**Analysis of muscular behavior in the knee joint in flexion from
different points of view.**

Fig. B

Right knee joint in semi-flexion. Antero-medial point of view.

11. tailoring

16. puny

Fig. C.

Right knee joint. Posterolateral view in section longitudinal.

5. iliotibial tract of the tensor fascia lata

7. rectus femoris

9. vastus lateral

19. biceps-long head

Fig D.

**Right knee joint in maximum flexion with antero-medial point of
view.**

7. rectus femoris

8. vastus medialis

11. tailoring

16. puny

Fig.E

Left knee joint. Posteromedial point of view.

p.m. medial pillar

(semitendinosus muscles and semimembranosus)

p.l. lateral pillar (biceps muscle)

g. gastrocnemius

Lesson 23

THE VERTEBRAL COLUMN AND THE LUMBAR, THORACIC AND CERVICAL VERTEBRAS

VERTEBRAL COLUMN

The vertebral column (Table I) is a long "flexible" bony rod made up of individual skeletal elements, the vertebrae, alternating pastes with discs of fibrous origin, called intervertebral discs, which represent the primary connection system.

In vertebrates, and therefore also in humans, the spine and pulp in the median and posterior condition of the body. It is a connection between the pelvis and the head and performs the function of supporting the entire upper structure of the human body, the weight of which is discharged on each individual vertebra and in particular on the area called "body" (see section fig. A1), a bony cylinder that acts as a supporting element of the vertebra itself. As the load progressively increases, as we approach the pelvis, the vertebral bodies do expand (fig. B).

The vertebral column is also a long bony "duct", the vertebral canal (see section Fig. A2), in which the spinal cord is located, which is protected from external pressures by the bony ring of each vertebra called the vertebral area.

The vertebrate column is also the fundamental support for the construction of the skeleton of the thorax; in fact, its region median

- called for the thoracic note - and as a paste of twelve vertebrae, from which the twelve pairs of ribs originate which, together with the sternum (see lesson 25), form the skeletal complex of the thoracic cage. This is the place of articular joint for the shoulder girdle and from the latter for the upper shoulder.

The vertebral column is composed of thirty-three vertebrae which take their name from the skeletal regions to which they belong:

seven cervical, twelve thoracic or dorsal, five lumbar. These twenty-four vertebrae are also said to be free. Of the remaining nine in the pelvic region, the five largest are salted and they constitute the sacred bones, while the last four and minor ones form the coccyx.

If we observe the column in its lateral profile (fig. B), we will notice how the four skeletal regions that compose it are oriented through a trend of opposite curvatures with respect to a vertical axis p (or man's lead) and how such curvatures are bounded by the axis itself in the points of conjunction of the various regions.

The cervical region or segment that keeps the head in balance finds an orientation with a slight anterior convexity with respect to the axis starting from its I vertebra, delta atlas, up to VII, called prominent.

The thoracic segment, in continuity with the previous one but with an opposite concavity trend, starting from its first vertebra will meet again the axis in the XII thoracic vertebra. This accentuated posterior curvature of the thoracic vertebrae ensures that the entire skeletal system of the rib cage is in a balanced condition and barycentric with respect to the axis.

The lumbar segment, which with its five vertebrae bears more the weight of the upper part of the body, is oriented, thanks to a greater rear compression of the discs, in contrast to the course of the thoracic tract, thus rebalancing, with its posture convex anteriorly, the vertebral column and bringing, with the V vertebra, the centre of gravity again in relation to the axis in the promontory of the sacra (fig. B, p.s.).

The sacrum (fig. B s) then moves curved and posteriorly up to the coccyx (fig. B c), thus conducting this system of opposing equilibriums.

Let us now analyse the proportional ratios of each region that makes up the spinal column. If we take two overlapping segments of equal length (fig. A) called S and to these we add a segment of measure $\frac{1}{2} S$, we will obtain measure C which corresponds to the height of the spine from the cervical I to the coccyx.

Starting from the top we will therefore find that the first segment - equal to $\frac{1}{2} S$ - identifies the height of the cervical region; the second segment S includes the thoracic vertebral tract and finally the third measurement segment S includes both the lumbar region and the pelvic region. Finally, to determine the ratios of measurement between these two regions we must divide the segment C into four equal parts: the measurement of $\frac{1}{4} C$ corresponding to the region of the lumbar vertebrae.

In this lesson we consider the sacrum as part of the vertebral column, although as we have already seen and partly treated, this element contributes to making up the skeleton of the pelvis. It is an element that we could define as a joint between the axial skeleton of the trunk and head and the lower it. It is analyzed in this context given that, in, is the result of the fusion of five vertebrae of which it retains some characteristics. Taken as a whole, it resembles a wedge (Plate I, figs. B-C-D): it has a pyramidal shape, with a larger base facing upwards, a massive body curved downwards with a smaller base on which the coccyx articulates and two lateral margins that degrade, progressively reducing their thickness downwards. The major base is characterised by an elliptical joint face (fig. C1) for the body of the V lumbar vertebra, aligned on an inclined axis (fig. B1) with respect to the lead (lumbo-sacral joint); posteriorly also presents two articular processes (fig. D2) which interact with the two lower articular processes of the lumbar vertebra.

The body is the result of a fusion of five vertebral carpi readable in an anterior frontal view (fig. C) and tapers and curved downwards, ending with an elliptical facet that articulates with the coccyx. At the rear it presents, in continuity with the vertebral canal, a triangular section duct called the sacral canal, obtained from the fusion of the vertebral arches; the canal in turn communicates with the four sacral foramina (fig. C D3), where nerves and vessels pass which connect the posterior plane with the anterior or ventral plane of the sacra; the sacral canal ends with an opening called the sacral jato (fig. D4), closed by ligaments.

Also posteriorly, the shape presents a series of squat and quadrangular reliefs that form the sacral crest (fig. B5); the lateral

margin, composed of the fusion of the transverse processes and the ribs, expands in the upper part and presents the auricular articular face (fig. B-D6), which recalls the shape of the pinna of the ear; from this the margin, descending and curving at the height of the lower lateral angle (fig. C7), progressively reduces its thickness until it joins the elliptical joint facet for the first coccygeal vertebra.

The coccyx is the last segment of the vertebral column and is composed of four small rudimentary vertebrae.

Tav. I

Fig. A

Vertebral column. schematic view. view in longitudinal section and in the proportional ratio.

C = overall height of the column

S = drive. measuring that corresponds to the height of the thoracic vertebrae segment

$\frac{1}{2} S$ = segment height of the cervical vertebrae

$\frac{1}{4} C$ = height of the lumbar vertebrae segment

Fig. A. section

1. body of the vertebra
2. vertebrate hole
3. vertebrate area

Fig. B

Vertebral column, lateral view. Cervical vertebrae:

- I c. first cervical vertebra (atlas)
- VII c. seventh cervical vertebra (prominent)
- It. First thoracic vertebrae
- XII It. twelfth thoracic vertebrae
- II. first lumbar vertebra
- VI. fifth lumbar vertebra

- di. intervertebral disc
- s.f. semi-facet (thoracic vertebrae)
- f.i. intervertebral foramen
- p.a. joint process
- p.s. spinous process
- s. sacra bone
- p.sa. promontory of the sacra
- c. coccyx
- 1. sacred bones; articular face for the V lumbar vertebra
- 5. sacral crest
- 6. auricular articular face.

Fig. C.

Anterior front view of the vertebrate column.

- I c. first cervical vertebra (atlas)
- II c. second cervical vertebrae (axis)
- f.a. articular facet of the transverse processes of the thoracic vertebrae
- c. body of the vertebra
- p.t. transverse processes
- 1. sacrum bones; articular face for the V lumbar vertebra
- p.sa. promontory of the sacred
- 3. sacral foramina
- 7. Lateral angle of the sacrum
- I v.c. first coccygeal vertebrae

Fig D.

Front posterior view of the vertebrate column.

- p.a. joint processes
 - 2. articular processes of the sacrum
 - 3. sacral foramina
 - 4. sacral jato
 - 5. sacral crest
 - 6. auricular articular face
-

Common characteristics of the vertebrae (Table II)

The vertebrae consists of a body (fig. B1), placed anteriorly, cylindrical in shape and varying in size according to the type of vertebra, in which two flat areas, firmly fixed to these, are the seat of the intervertebral discs of fibrocartilage, joint pads make the whole column flexible but extremely integral.

From the posterior margins of the body of the vertebra, through a small skeletal segment, the peduncle originates (fig. C2); this, detaching posteriorly from the body, constitutes the base of a bony plate that creates the skeletal ring called the vertebral arch (fig. B3); this arch in turn delimits the hollow area called the vertebral hole (fig. B4).

Seven processes depart from the lamina: the two transverse processes, the four articular processes and the spinous process.

The transverse processes (fig. B5), oriented transversally to the anterior posterior axis of the vertebra, are particularly robust and emerging from the body, particularly in the lumbar vertebrae; in doing so, they provide anchorage to the tendons and muscles that act on the movement of the spine; moreover, in the thoracic vertebrae they participate in supporting the ribs.

The four articular processes are divided into two superior processes (fig. C6) and two inferior processes (fig. C7); these protrude from the lamina of the vertebral arch and are equipped with articular facets which, in the joint between vertebra and vertebra, guide and limit their movement.

The spinous process, also called the spine (fig. C8), and oriented on the anterior posterior axis; spreads from the lamina and acts as a muscle attack; Its shape is extremely variable depending on the type of vertebra.

Example of "type" vertebrae

Fig. A
Volumetric anterior view.

Fig. B
Top view.

1. body
2. peduncle
3. vertebral area
4. vertebral hole
5. transverse process
6. upper articular process
8. spinous process

Fig. C.
Side view.

7. lower articular process

Fig D.
Volumetric rear view.

Lumbar vertebrae.

Fig. A
Superior vision.

1. body
2. peduncle
3. vertebral arch
4. vertebral hole
5. transverse process
6. upper joint processes
8. spinous process

Fig. B
Side view.

i.v. upper / lower vertebral notches

7. lower joint processes
f. facet joint

Fig C.
Front front view.

Fig D.
Front rear view.

THE VERTEBRAS: LUMBARS, THORACICS, CERVICALS

Lumbar vertebrae (Table I)

They are the largest and most massive of the column.

Body (table I, fig. A1): particularly voluminous, and more dilated in the transverse direction. At below the peduncle (fig. B2) and above there are notches, common to all the vertebrae, which are made up of lower and upper vertebral notches (B i.v.), which, in the continuity of the positioning of the vertebrae, create a hollow area called intervertebral foramen (see table III, f.i.). The nerves pass through this cavity spinal cord originating from the spinal cord.

Vertebral hole (fig. A4): it is wider than the other vertebrae and triangular in shape.

Transverse processes (fig. A5): they are thin and long.

Upper articular processes (fig. B6): they are developed on a vertical axis and of massive shape. The articular facets (figs. D f), of elliptical shape, with major vertical expansion, they are facing medially and backwards.

Inferior articular processes (fig. B7): the inferior articular facets (figs. C-Df) are turned sideways and forward, unlike the superior ones.

Spinous process: it is flat and rectangular, directed horizontally with respect to the body.

Thoracic vertebrae (Table II)

The body (fig. A1): it is more developed and equipped in the sagittal direction. Observing the vertebral body from the side (fig. D), on the upper and lower margin, two semifossettes (fig. D s.f.) can be seen and these, combining in the superimposition of the vertebrae, form a single hollow that welcomes, articulating with it, the head of the coast. On the joint dimples, with reference to the twelve thoracic vertebrae, some variations are to be noted on the 1st thoracic vertebra, a single upper dimple is observed for the 1st rib and a semifossette for the 2nd rib; from the X to the XII vertebrae there is only one complete dimple for the corresponding rib. The joint pits on the transverse processes of the 11th and 12th thoracic vertebrae are absent.

Vertebral hole (fig. A4): it is smaller and more circular.

Transverse processes (figs. A D5): they are longer and more developed, facing laterally and posteriorly. At their extremities they have small joint pits (figs. A-C-D f.a.) for the tubercle of the rib. The transverse processes thus ideally become small "corbels" for supporting the coasts.

Upper articular processes (figs. A-D6): they are directed upwards and more slender than the lumbar articular processes. Hanna flat facets (fig. B f.) And facing backwards.

Lower articular processes (figs. B-C-D 7): they do not emerge like the upper processes from the edges of the lamina because they are totally incorporated there except for a modest relief. The facets (f.) Face anteriorly.

Spinous process (fig. D8): long and directed downwards with respect to the body.

Thoracic vertebrae.

Fig. A
Superior vision.

1. body
2. peduncle

- 3. vertebral arch
- 4. vertebral hole
- 5. transverse process
- f.a. facet articulate
- 6. upper articular process
- 8. process thorny

Fig. B

Front rear view.

- 7. lower articular process
- f. facet joint

Fig. C.

Front front view.

Fig. D

Side view.

s.f. semi-facet

Tav. III

Fig. A-B

Anterior-lateral volumetric view. The column is visualised in the distinction of the 24 vertebral bodies, the vertebral hole and the transverse and spinous processes.

- c. body
- f.v. vertebral hole
- p.t. transverse process
- p.s. spinous process

Fig. C.

Definition of the column in analytical detail.

- f.a. facet joint (transverse processes of the thoracic vertebrae)
- s.f. half-facets
- f.i. intervertebral foramina

NB - they are specifically excluded from observation the transverse processes of the cervical vertebrae.

Cervical vertebrae (plate IV)

They are the smallest in the spine.

The body (fig. A1): small and less developed than in the other vertebrae and more dilated in the transverse direction.

Vertebral hole (fig. A4): it is broad and triangular, delimited obliquely by the lamina of the vertebral arch (fig. A3).

Spinous process (figs. C D8): it is short and bifid, slightly inclined downwards.

transverse processes (fig. A5): present at their base the transverse hole (fig. A f.t.) and at the apex two tubercles, one anterior (fig. A t.a.) and one posterior (fig. A t.p.).

The superior (fig. D6) and inferior (fig. D7) articular processes are located behind the transverse processes, with the facets directed obliquely: in the whole of the vertebrae they form a real cylindrical columnar element placed on the sides of the lamina (see table . VII p.a.).

VII cervical vertebrae: prominent (plate IV, fig. E)

The peculiarity of this vertebrae consists of its spinous process (fig. E8), much longer and inclined downwards and with a single tubercle apex. The latter emerges on the skin, especially in the bending movement of the glue. The protrusion of the spinous process becomes an important point for identifying the base of the glue posteriorly (see table VII p.s.).

Cervical vertebrae.

Fig. A
Superior vision.

1. body
3. vertebrate arch
4. vertebrate hole
5. transverse process
- f.t. transverse hole
- t.a. anterior tubercle
- t.p. posterior tubercle
6. joint process
- f. facet joint
8. spinous process

Fig. B

Front front view.

Fig. C.

Front rear view.

7. lower articular process

Fig D.

Side view.

Fig. E

VII cervical vertebra (prominent).

- t.a. anterior tubercle
- f.t. transverse hole
- t.p. posterior tubercle
8. spinous process

I Cervical vertebrae: atlas (plate V)

The body is absent; in its place is the anterior vertebral arch (plate V, fig. A1) with a small protruding tubercle. The posterior vertebral arch (fig. A3) is wider and also has a tubercle (fig. A t.). The vertebral hole (fig. A4) is circular and broad; laterally there are two dilated masses (fig. A6) which form the upper articular face (fig. A f.a.), elliptical and concave for the occipital condyle of the head

and the lower articular face (fig. B f.) for I ' axis. On the internal lamina of the anterior vertebral arch there is a facet (fig. E s.a.): and a small articular surface for the axis of the axis.

II cervical vertebrae: axis (plate VI)

Characteristic of this vertebrae is the protrusion of the odontoid process, called the tooth of the axis (plate VI, fig. A d.). It articulates with its own facet (fig. B f.d.) with the corresponding internal facet of the anterior vertebral arch of the atlas. The tooth thus becomes the pivot on which the atlas (fig. F) finds the possibility to rotate laterally, consequently dragging the head with it in the movement. The tooth is held in place by the transverse ribbon-like connection of the atlas (see table V, fig. A), which, taking insertion at the inner sides of the lateral masses of the atlas and passing into the groove of the tooth of the axis (figs. CDE s.d.), holds it in contact with the anterior arch of the atlas.

Fig. A (Table V)

I cervical vertebra (atlas).

- 1. anterior vertebral arch
- 3. posterior vertebral arch
- t. tubercle
- 4. vertebral hole
- 5. transverse process
- 6. joint process
- F.a. facet joint for the occipital condyle
- leg. ribbon-like ligament

Fig. B

Front rear view.

- 7. lower articular process
- f. facet joint

Fig. C.
Side view.

Fig D.
Front front view.

Fig. E
Volumetric vision.

s.a. articular surface for the tooth of the axis

Fig. A (Plate VI)
II cervical vertebrae (axis).
Superior vision.

d. spindle tooth
3. vertebrate arch
4. vertebral hole
5. transverse process
6. upper articular process
f. facet joint

Fig. B
Front front view.

d. tooth of the axis
f.d. articular facet of the axis of the tooth

Fig. C.
Front rear view.

s.d. sulcus of the tooth of the axis

Fig D.
Side view.

Fig. E
Volumetric vision.

Fig.F

Volumetric view of the two superimposed atlas and axis vertebrae.

Fig. A

Volumetric posterior lateral view of the vertebral column.

p.s. spinous process - VII cervical vertebra (prominent)

Fig. B

Posterior lateral view in analytical detail.

p.a. joint processes

Fig. C.

Posterior lateral view.

Healthy vertebrae were isolated:

a. IV cervical vertebra

b. IX thoracic vertebra

c. II lumbar vertebra

Lesson 24

THE MOVEMENTS OF THE SPINE

Proportional reconstruction of the vertebral column and its relationship with the skeleton of the head: the column is seen as a unitary volume that summarises in a single form the alignment of the vertebral bodies and the various processes that characterise it.

Tav. I

Fig. A

Front side view.

We can distinguish in this unitary form in "transparency" the following vertebrae:

- I c. first vertebra cervical (atlas)
- II c. second cervical vertebra (axis)
- VII c. seventh cervical vertebra (prominent)
- I t. first thoracic vertebrae
- XII t. twelfth thoracic vertebrae
- I.l. first lumbar vertebra
- V.l. fifth lumbar vertebra
- s. sacrum
- c.o. coccyx

and the alignment of the following vertebral segment:

- c. vertebral bodies
- a.v. vertebral arches
- p.a. joint processes
- p.t. transverse processes
- p.s. spinous processes

Fig. B

Front front view.

c. vertebral bodies
p.t. transverse processes

Fig. C.
Front rear view.

p.a. joint processes
p.t. transverse processes
p.s. spinous processes
to. v. vertebral arches

The vertebrate column, composed as a whole by the vertebrae and the intervertebral discs, with its particular conformation (see Section 23), created by the series of opposing curvatures represented here in a synthetic way in the table. I, makes the whole capable of gradually distributing the mechanical forces that act on the shape on each single element and on the different curvatures, both in a static and dynamic situation. The elements that perform the function of joint pads are the intervertebral discs: made up of fibro-cartilage material that makes them elastic, they consequently cushion the thrusts of the forces that weigh on the structure and make the entire spine flexible.

The articular processes are the skeletal elements that limit and guide the movement of this bone shaft, determining the possibilities of excursion, based on the type and angular degree of specific articulation in the various cervical-thoracic and lumbar segments. It is no coincidence that the cervical signal, given the modest inclination of the articular faces, which therefore allows a wider radius of curvature, among all the signals is the most mobile, while the most rigid signal is the thoracic, also given its supporting function. of the rib cage.

Overall in the movements the cervical region is the most mobile, followed by the lumbar region. Much more limited is the movement of the thoracic region

Now briefly describe the main movements of the spine.

Flexion (plate II, fig. B1): The column moves forward, bending on itself; it is the broader movement also called antiflexion. Extension (fig. B2): movement opposite to the previous one also called retroflexion more limited than flexion because it is contained by the almost vertical arrangement of the articular processes of the lumbar and thoracic vertebrae.

Lateral inclination (fig C): angular movement towards the outside, even more limited. In the lateral inclination there is flexibility on all regions

Rotation (fig. A): movement on its own longitudinal axis; has a greater degree of rotation in the cervical tract and progressively decreases up to the lumbar region where it is very limited, while it is totally impossible at the level of the pelvic region, constrained by the pelvis; this movement transmits an interesting helical trend to the column.

Table II

Movements of the spine.

Fig A.
rotational movement on its longitudinal axis.

Fig. B
1. flexion movement also called antiflexion
2. flexion movement: being reverted to a posterior trend and also called retroflexion

Fig. C.
Lateral tilt movement.

Lesson 25

THE SKELETON OF THE CHEST: RIB CAGE PROPORTIONAL RELATIONS AND VOLUME.

RIB CAGE

The skeleton of the thorax is constituted posteriorly by the twelve thoracic vertebrae, by the twelve pairs of corresponding ribs and arranged in an arched course from the back to the front, and by the sternum, the central and anterior element to which they relate. This set of elements is clarified in the rib cage and contains and protects the main organs of circulation and respiration. The resulting shape is basically conoidal and has two openings, one upper and one lower more expanded. The elements that delimit this hollow form are the thoracic vertebrae (see lesson 23), the ribs and the sternum. Let us now try to go into the analysis of this complex apparatus starting from the ribs.

The ribs (plate I), in number of twelve pairs, are flat and ribbon-like bones and in their arcuate and oblique course from the top to the low concur to form for the most part the skeleton of the thorax (table I, figs. A-B)

Each rib is made up of a long bony portion and a shorter cartilaginous portion (fig. B, p.o.- p.c.), by means of which the rib articulates with the sternum. However, not all the ribs with their corresponding cartilage portions find direct insertion into the sternum.

The ribs, in fact, are articulated with the sternum in a direct and indirect way. If we observe them starting from the top (figs. A-B-C), we will notice that the first seven are directly connected to this with their cartilage portion and are therefore clarified sternal ribs.

The VIII, IX and X are connected with their cartilaginous tract, not directly to the sternum but to the cartilage of the directly overlying rib; consequently they are clarified asternals or spurious ribs. The

last two, the XI and Ia XII, shorter, have no relationship with the sternum and are free or fluctuating ribs and lack a cartilage portion.

The arched and oblique movement, from the back to the front and from the top to the bottom (fig. B), proceeds from I to IX, gradually increasing the downward inclination and then gradually reducing it from X to XII. Between one coast and the other there is a hollow space clarified intercostal space (fig. B s.i.). As the inclination so also their length varies; in fact it increases with a rapid growth from I to IV rib, lighter up to VII (point of the thorax more expanded in width), and then gradually decreases up to IX and then with rapid succession up to XII, thus contributing to together this characteristic conoid and hollow shape, with a minor base at the top and a major base at the bottom (fig. C).

As in inclination and length, as well as in shape, not all ribs are the same; in fact I, II, XI and Ia XII denote their own characteristics, while the others, from III to X, can all be included within a common typification.

Let us analyse, for example, a medium-sized rib, the VI. The rib has a body (figs. D-E) and two external ones, posterior and anterior; the posterior extremity denotes a head (fig. D t.) of pyramidal form with two facets (figs. EF 1-2), which are articulated with the corresponding facets of the thoracic vertebrae, while the small horizontal crest that divides them (Fig. E3: see also Fig. F) finds articulation with the intervertebral disc. We can note that the lower articular facet always articulates with the vertebra of the corresponding number, while the upper facet communicates with the overlying vertebra (Fig. F and detail). This applies to the ribs and the vertebrae starting from II to X. The I rib, on the other hand, articulates with a single facet on the body of the I thoracic vertebra; this type of articulation also applies to the 11th and 12th ribs. As a check, the arrangement of the facet joints on the thoracic vertebral carpi can be compared (see lesson 23). The head is followed by a short glue (figs. D-E-F c.) Which ends posteriorly in a tubercle (figs. D-E-F tub.); and an emergence showing a small articular facet (figs. D-E-F4) for the transverse process facet of the corresponding vertebra (see fig. F5). This articular system makes the head the fixed point or pivot of movement and the transverse

process is a sort of shelf that supports the rib laterally, which finds an axis of rotation in the glue (from the head to the tubercle).

The movement of the ribs is linked to the mechanics of breathing. The movement of the thoracic cage during breathing is transverse on all the coasts and determines a transverse dilation of the chest in the inhalation and a reduction of the latter in the exhalation; The possibility of cage dilation is allowed by the elasticity of the costal cartilages (fig. G).

Tav. I

340 / 5000

Translation results

Fig. A

Frontal view of the rib cage with the exclusion of the cartilaginous tracts and exploded view of the sternum.

I c. / XII c. ribs

i.e. costal incisions

a.c. costal angles

Fig. A (section)

View from above: trend of the VIII coast.

t. head of the coast

c. neck

tub. costal tubercle

a.c. costal angle

i.e. costal notch

Fig. B

Left lateral view of the rib cage excluding the thoracic vertebrae: we can see the alignments of the costal angles, of the costal notches and of the heads of the ribs.

c. it costs

s.i. intercostal space

p.o. bony portion of the rib

p.c. cartilage portion of the rib

s. sternum

Fig. C.

Right anterolateral view of the rib cage.

Ic./VII c. sternal ribs

VIIIc./Xc. asternal ribs

XI c. / XII c. free coasts

Fig D.

External view of the VI right rib

t. head

c. neck

tub. costal tubercle

i.e. costal notch

c.c costal cartilage

f.s. sternal facet

Figs. D1- E1

Detail of the torsion curve of the 6th rib.

Fig. E

Internal view of the VI right rib.

1. upper articular facet

2. inferior joint facet

3. crest

4. articular facet of the costal tubercle

Fig. F

Anterolateral view of the ribs in their articular relationship with the vertebrae and section of the ribs and the musculature of the thoracic cage, formed by three layers of muscles: the intercostals.

leg. costo-transverse ligaments

d.i. intervertebral disc

f.e. outer face of the coast

f.i. inner face of the coast

m.s. top margin

5. articular facet of the transverse process of the thoracic vertebra

6. external intercostal muscle

- 7. intercostal muscle
- 8. internal intercostal muscle

Fig. G.

Movement of the rib in relation to that of the rib cage.

- 1. inhalation movement
 - 2. exhalation movement
-

The ribbon-like body of the rib begins from the tubercle (fig. D). It is formed by two faces and two margins (fig. F): the outer face is rounded and convex, while the interior, slightly concave, denotes a groove in the lower part (fig. F), in which the muscles are located. Intercostal muscles. The sharp lateral edge of the furrow thus connotes the lower edge of the coast; the upper margin is instead slightly rounded. The body, moving from the tubercle posteriorly and towards the outside, has a directional apex called the rib angle (figs. D-E a.c.). From this point the coast changes its direction moving forward with an arched and twisted movement up to the front end. The anterior extremity ends with an incisure (fig. D i.c.), on whose facet the cartilaginous segment (figs. D-E c.c.) is fixed, which moves upwards on the sternum.

As we have noted, there are some differences between the skeletal elements of the ribs, both in the way of articulation with the vertebrae, both in the length and in the way of connecting to the sternum. The difference in shape that can be seen in the I, II, XI and XII is linked to the greater width of the body and to the orientation of their torsional curvature. In fact, in the I and II ribs (figs. A-B-C) the body, starting from the tubercle, immediately moves towards the anterior part, thus bringing the costal angle near the tubercle; in particular, in I, the rib angle almost coincides with the tubercle, consequently accentuating the curve of the rib itself.

From the rib angle and up to the incisure, the I and II ribs have a flattened and wider body, arranged horizontally (see fig. A) which causes their faces to look up and down and that consequently, the edges are arranged inwards and outwards. On the other hand, starting from III and up to X, the faces tend to arrange themselves

more and more obliquely and then vertically, so that the margins turn up and down.

This "flat" course of the first two ribs offers a valid basis for the muscles that combine to form the root of the glue (II muscle group of the scalene). As regards the XI and XII, the so-called free ribs, these lack tubercle and cartilage portion and the lamellar and slightly curved gold body ends in a pointed way.

The combination of this set of characteristics identifies, in an overall analysis of the movements of the coasts, two trajectories particularly characterising for the shape of the thoracic cage, one anterior due to the alignment of the costal notches, which distinguish the bone tract from the cartilaginous one (figs. . AB i.c.), and a posterior one, due to the alignment of the costal angles (figs. AB a.c.). This posterior trajectory creates in its entirety the limit of the so-called pulmonary shower; this posterior depression, narrower and closer towards the top and progressively widened towards the bottom, contributes with its posterior development to bring the thoracic cage into equilibrium with respect to the axis, balancing the anterior development of the thorax.

The sternum

It is a flat bone (fig. H), symmetrical, arranged along the median of the trunk, wider in the upper end, while in profile it has a slightly convex anterior. It is made up of three parts, salted between them: an upper one (the dumbbell), a middle one (the body) and a lower one (the xiphoid [sword-shaped] process).

The handlebar (fig. H m.) Is similar in shape to a trapezoid, more wide and thick in the upper portion; this one, in its upper margin, has a small depression in the jugular incisure (fig. H1) and also a sternal fork, interesting because it constitutes an important reference limit for identifying the anterior root of the glue in an epidermal observation.

On the sides of this there are two hollowed facets, called clavicular incisions (fig. H2) for the articulation with the clavicles. Below, on

the lateral margins, we observe an incisor for the connection with the 1st rib, while still further below, in the lower margin, between the handlebar and the body, we notice a second incisor for the 2nd rib.

The body, elongated in shape, and wider in the lower extremity. It presents at its margins the notches for the remaining sternal ribs from III to VII.

The last notches are more close together. The xiphoid (Sword-shaped) or ensiform process has a small variable shape, elongated and narrow and sometimes perforated, which becomes an epidermal reference for the identification of the apex of the anterior costal arch.

Fig. A

Frontal view of the rib cage reconstructed in its proportional relationships.

- a. centre of the upper orifice
- c. ribs
- c.c. rib cartilage
- s. sternum
- i.e. trend line of costal incisions
- a.c. trend line of the costal angles

Fig. B

Side profile. The inclination of the sternum corresponds to the angular measure of 20 °.

Fig.H

Frontal view and lateral profile of the sternum.

m. sternum dumbbell

- c. body
- xi. xiphoid or ensiform process
- 1. jugular notch
- 2. clavicular incisions

I c./VII c. incisions for the sternal facets of the ribs from the 1st to

the 7th rib

VOLUMES AND PROPORTIONAL RELATIONS

We have just analysed the individual elements that make up the chest skeleton. Let's now observe the shape as a whole, from the point of view of the front, side and rear profile. This conoidal or, better said, truncated pyramidal shape shows four faces and two "bases" or orifices, one upper and one lower.

Front face (Table I, fig. A)

It consists of the sternum, the costal cartilages and the line of the rib incisions (fig. A i.c.), a line that marks the limit of the anterior ends of the ribs in their skeletal tract; this face is inclined and slightly convex.

Side faces (fig. B)

They are convex and the area arrangement of the coasts is visible. It is also visible the alignment of the incisions thus such (fig. B i.c.) and, posteriorly, of the angle thus such (fig. B a. C.), The posterior limit of the form.

Back face

Characterised by the area called pulmonary shower that goes from the vertebrae to the alignment of the costal angles: in the drawing (table I, fig. C) the vertebral column is represented only in the vertebral carpi in order to better identify the joint relationship of the rib heads with the vertebral carpi themselves and the inclined alignment of the articular faces of the rib tubercles, wider on the 1st tapering up to X.

Upper orifice (fig. D)

It has an elliptical perimeter - with a larger diameter in the transverse direction - which in a profile observation (fig. B) is inclined anteriorly. It is delimited posteriorly by the 1st thoracic vertebra, laterally by the 1st rib and anteriorly by the superior edge

of the sternum manubrium.

Lower Orifice

It presents, in an anterior view (fig. A), two arches limited by the inferior margin of the costal cartilages and united centrally in the inferior extremity of the sternum, in an angle called infrasternal angle. In a posterior view (fig. C) these arches find continuity in the lower margin of the XII rib and end in the XII thoracic vertebra.

For a proportionate reconstruction of the thoracic cage in its relationship also with the vertebral column (lumbar tract) and the badno, we can still use a modular subdivision (table I, fig. E). We then consider the module T, equivalent to the measure of the head (see lesson 2); we note that the measure from the pubis (fig. E1) to the handlebar of the sternum (fig. E2) is equivalent to $2T + 1 / 2T$. Subdividing the measure thus obtained into three parts we obtain the measure F. The first segment F. I corresponds to the height of the sternum handlebar, tangent in turn to the small circumference that indicates the head of the humerus (fig. E3), up to the centre of the maximum circumference of the rib cage (fig. E4).

This centre corresponds to the base of the sternum; the tip of articulation with the xiphoid process and also tip of the greater lateral skeleton of the thorax. This height in the lateral profile also corresponds to the greater depth of the thoracic cage to the extent of a T module. These data can be used to perform a volumetric reconstruction of the shape, as can be seen in table II.

Fig. C.

Front rear view: notice the exclusion of the arches vertebral and transverse processes of the vertebrae in order to obtain a better reading of the alignment of the costal tubercles.

tub. costal tubercles

a.c. alignment of the costal angles

Fig D.

Top view of the rib cage.

- o. centre of the upper orifice
- 1 jugular notch
- 2 clavicle notch
- a.c. costal angles
- i.c. costal incisions

Fig.E

Diagram on the modular relationships of the thoracic cage and its relationship with the pelvis.

- T head module
 - F modular ratio corresponding to the face
 - 1. pubis
 - 2. sternum dumbbell
 - 3. circumference corresponding to the head of the humerus
 - 4. centre of the construction circumference of the rib cage perimeter
-

Fig. A

Three-dimensional reconstruction of the rib cage structure: we note the intersection of the two sagittal and frontal planes.

- o. centre of the upper orifice
- 2 tip corresponding to the handle of the sternum
- 4 point of intersection on the axis corresponding to the line of greatest transverse width of the rib cage.

Fig. B

Identification of the pulmonary shower surface.

- a.c. alignment line of the costal angles

Fig. C

Reconstruction of the overall volume.

- i.c. alignment line of such notches

Fig D.

Anterior and posterior volume: the two "shells" of the thoracic cage sectioned on the frontal plane.

Fig. E

Overall volume showing the VII trend line (demarcation line between the sternal and asternal coasts).

s. sternum

Detail E

Course plan of the VII coast.

Fig. F

Course trajectories of the coasts.

Fig. G-H

Volumetric view of the anterior and posterior rib cage

VII coast and subdivision of the two sternal and asthma and free areas.

Fig. I

Overall volume of the thoracic cage, with skeletal definition of the right side.

Lesson 26

THE SKELETON OF THE HEAD

It is a set of bone elements with the function of supporting and containing the brain and the sense organs and for taking and chewing food.

The skeleton of the head (Plate I) is called a skull or cranium. The upper part of the skull, composed of the elements that enclose and protect the brain, is called the box or skull cap. It is an ovoid shape, particularly noticeable in a lateral view, where the ellipsoidal shape presents a greater dilation in the lower posterior part, corresponding to the occipital region.

The rest of the skull enclosing the sense organs and defined as the skeleton of the face. This is fixed to the cap, with the exception of the lower mobile part, composed of the mandible. Overall it has a prismatic shape, hollowed out by the openings of the orbital cavities and the nasal cavity.

The orbital cavities are two containment pits for the eyeballs; they have an approximately pyramidal shape, with the base corresponding to the orbital opening or orbital margin and the pice coinciding with the upper orbital slot located at the bottom of the cavity itself; each orbit thus has a vault, a floor, a medial and a lateral wall.

The nasal cavity, due to its pear shape, is called the piriform opening, being wider at the bottom than at the top. Overall, the head is made up of twenty-two bones, eight of which make up the cap and the remaining fourteen form the skeleton of the face.

The cranial vault and the face are composed of single and double bones as in the following diagram:

CRANIAL VAULT

Frontal (f.)

Parietal (p.) Parietal (p.)

Ethmoid (e.)

Sphenoid (s.)

Thunderstorm (t.) Thunderstorm (t.)

Occipital (o.)

FACE

Nasal (n.) Nasal (n.)

Lacrima (l.) Lacrima (l.)

Zygomatic (z.) Zygomatic (z.)

Maxillary (m.) Maxillary (m.)

Vomer (vb)

Concha (c.) Concha (c.)

Palatine (pa.)

Mandible (ma.)

THE CRANIAL VAULT

We can compare it to a building with a floor, vaulted ceiling and arched walls placed at the front, rear and side.

It should be noted that the boundary of the individual bones is delimited by a type of fixed joint called synarthrosis, consisting of real serrated joints called suture lines. This particular type of joint perimeter leads us to consider the "mosaic" shape of the head as a single whole and it is through this global vision that we analyse the individual skeletal parts, seen in relation to the totality of the shape.

The frontal bone (Plate I, f)

It is a single bone and forms the anterior wall of the cranial vault corresponding to the forehead region, while in its lower part it forms a large part of the vault or "ceiling" of the orbital cavity.

Its external surface, convex in the central region of the forehead,

has two rounded reliefs called frontal projections (figs. A-B1), under which, after a small depression, the shape expands into two arched and pronounced reliefs that form the superciliary arches (figs. A-B2). These two reliefs are joined on the median line of the head in a flat section called the glabella (fig. A3).

Underneath the two arches, the form folds at an angle thus constituting the supraorbital margin, the upper anterior limit of the orbit (figs. A B4), and moves towards the interior of the orbital cavities, forming the "ceiling".

The frontal bone also contributes, with a small portion, to the construction of the lateral face of the skull. As we can see, the upper edge of the orbital openings ends laterally, expanding into a robust and protruding relief called the zygomatic process (figs. A-B5). From this limit or anterior ridge of the form begins the lateral wall called the temporal face of the frontal, characterised by a curvilinear relief, more accentuated near the zygomatic process, called the temporal crest (fig. B6). This relief finds continuity with the temporal line of the parietal bones, a line which in turn, pushing up to the mastoid process of the temporal bone, distinguishes the upper limit of the origin of the temporal muscle (fig. The depression called the temporal fossa (figs. BD f.t.).

The front has three margins: the posterior margin articulates with the parietal bones by means of the coronal suture (figs. B-D-E7); the lower margin articulates with the facial, nasal, maxillary, lacrimal, ethmoid, sphenoid and zygomatic bones; the lateral margin, in the sphenofrontal suture (figs. B-D8), articulates with the large wing of the sphenoid.

The parietal bones (plate I p.)

They contribute to the formation of the lateral walls of the skull. Their outer face is convex and quadrilateral in shape. Analyzing this shape, we will notice a long and indented upper margin called sagittal (figs. E-G9), which joins the two parietals on the homonymous axis; anteriorly it meets the coronal suture at the highest point of the crania, called bregma. the anterior margin articulates with the frontal; the lower margin can be divided into three distinct suture sections: the anterior with the large wing of

the sphenoid (sphenoparietal suture: figs. B-D10); the median tract, which is wider, articulates with the scaly part of the temporal bone (temporoparietal suture: figs. B-D11); the posterior articulates with the mastoid and / or temporal tract (parietomastoid suture: figs. B-D 12).

The posterior margin creates an extremely jagged suture line in its joint with the occipital (lambdoid suture: figs. B-D-E-G 13).

The temporal bones (plate I t.)

They complete the lateral walls of the skull and contribute to the formation of the "floor" of the skull itself. Of these bones we can distinguish three parts or regions: the scaly part or scale (fig. B sq.), The most expanded, the mastoid region (fig. B max.) And the petrous rock (fig. F pe.).

The scale is the expanded and lateral portion of the temporal and concurs to form the lateral face of the temporal fossa. It is lamellar and smooth in shape, slightly convex and articulates at the top with the parietal and anteriorly with the large wing of the sphenoid. In the posterior part, the scale is covered by a relief, the supra-mastoid crest (fig. B and detail fig. C14). Thanks to its curved course this relief finds continuity, posteriorly, with the temporal line of the parietals, thus defining the limit of the area of origin of the temporal muscle (fig. C).

The supramastoid crest, anteriorly, forms the posterior root of the bony arch called the zygomatic process (fig. B-D and particular fig. C15). The process is composed of a lamina which, anteriorly, is articulated with the zygomatic bone, in the temporozygomatic suture (fig. B16), thus creating the so-called zygomatic arch (fig. F a.z.). This arch is external limitless of the large depressed and lateral area of the crania called temporal fossa which together with this bony arch creates a cavity inside which the temporal muscle responsible for chewing passes (fig. C). This, originating from the temporal fossa, finally finds its insertion into the coronoid process of the mandible.

The posterior root of the arch of the zygomatic process, in its lower part, houses the orifice of the acoustic meatus (detail fig.

C17) and the cavity of the mandibular fossa (fig. F18), the place where the condyle of the jaw.

In the posterior part of the temporal bone, below the supramastoid crest, the shape expands into the robust mastoid process, of conical shape, an important place of insertion of a muscle of the glue, particularly visible in its path, the sternocleidomastoid.

Finally, the petrous rock contributes to the formation of the "floor" of the crania, wedging between the sphenoid and the occipital. This pyramidal skeletal part contains the hearing organ which communicates with the orifice of the auditory meatus. From the lower face of the petrous rock arises a pointed apophysis, the styloid process (Fig. Be detail Fig. C19), which becomes the place of insertion of some muscle bundles of the joid bone.

Table I

Fig. A

Anterior front view of the skeleton of the head.

- f. front
- 1. frontal drafts
- 2. superciliary arches
- 3. glabella
- 4. supraorbital margin
- 5. frontal zygomatic process
- 6. temporal crest of the frontal
- p. parietal
- t. thunderstorm
- s. sphenoid
- e. ethmoid
- l. lacrimal
- n. nasal
- v. ploughshare
- m. maxillary
- z. zygomatic
- m.a. jaw

Fig. B

Side profile of the skeleton of the head.

- f. front
- 7. coronal suture line
- 8. Sphenofrontal suture line
- p. parietal
- 6. temporal line of the parietal
- 10. Sphenoparietal suture line
- 11. temporoparietal suture line
- 12. parietomastoid suture line
- 13. Lambdoid suture line
- t. thunderstorm
- 14. supramastoid crest
- 15. zygomatic process of the temporal
- 16. Temporozygomatic suture line
- 19. styloid process
- 20. occipital protuberance
- max. mastoid process
- f.t. temporal fossa

Fig. C.

Side profile of the skeleton of the head. The zygomatic arch was dissected to highlight the trend of the temporal muscle.

m.t. temporal muscle

Detail Fig. C

The temporal bone isolated.

- sq. scale of the storm
- 17. acoustic meatus

Fig. G.

Frontal rear view

- 21. superior nuchal line
- 22. inferior nuchal line

Fig D.

Left posterolateral view of the skeleton of the head.

Fig. E

Top view of the cranial vault.

9. sagittal suture line

Fig.F

Inferior view of the skeleton of the head.

t. thunderstorm

mas. mastoid process

pe. rocca petrosa

18. mandibular fossa

o. occipital

f.o. hole of the occipital

23. condyles of the occipital

24. Basic process of the occipital

s. sphenoid

z. zygomatic

a.z. zygomatic arch

m. maxillary

p.p. palatine process of the maxilla

pa. palatine

The occipital bone (Plate I o.)

Complete the posterior wall and the base of the skull. In its lower portion it is characterised by a hole, called the great occipital hole (fig. F 10), where the cranial box finds a place of communication with the cervical canal.

Its convex outer surface consists of the occipital scale which articulates with the two parietal bones by means of the lambdoid suture (figs. B-D-G 13). Along the median line we notice a small relief, the external occipital protuberance (figs. B-G 20). From this the upper (fig. G21) and lower (fig. G22) nuchal lines symmetrically branch out. These slight ridges will be places of origin of the posterior muscles of the back and of the glue. The lower part presents, at the side of the foramen magnum, two elliptical and rounded reliefs called the condyles of the occipital (fig. F23): these are the places where the head, interacting with the upper facets of the first vertebra, the atlas, finds articulation with the bony shaft of the vertebrae.

The sphenoid (plate II s.)

This element is in the anterior base of the skull and is a nodal element in the connection between all the bones of the skullcap, of which it completes the anterior portion, and five bones that are part of the skeleton of the face: the vomer, the two palatine and the two zygomatic. It is composed of a prismatic central body from which six processes branch off: the two large wings, the two small wings and the two pterygoid processes. Since it acts on a deep plane, what is visible in a reading of the external morphology are above all the two large wings (figs. A-B g.a.), equipped with two faces, one on the lateral front of the crania and one in the orbital cavity.

The lateral portion is called the temporal face of the great wings. This face articulates with the frontal, parietal, temporal and zygomatic. With its concave surface, it forms the most depressed part of the temporal fossa wall, from which a portion of the temporal muscle originates. The orbital face is quadrilateral in shape and constitutes the deepest and most posterior part of the lateral face of the orbit, articulating with the zygomatic and with the front. The small wings, still in the orbital cavity, are pasted above the large wings and separated from them by the superior orbital fissure (fig. A1), through which the nerves for the eye muscles pass.

The ethmoid (pl. II e.)

It is largely hidden from external vision, since it is located in the anterior part of the skull base. Its cubic shape is similar to a wedge and helps to form the medial wall of the orbits; moreover, in its deep parts, it contributes to the formation of the lateral walls of the nasal cavity and, with its perpendicular lamina, to the constitution of the nasal septum.

In the medial walls of the orbital cavity, by means of the papyrus lamina (fig. B2), the ethmoid articulates at the top with the orbital part of the frontal, at the bottom with the maxilla and anteriorly with the lacrimal.

THE BONES OF THE FACE

The lacrimal bones (plate II l.)

They are two small elongated and thin bones. Together with the lamina papyracea of the ethmoid they form the medial wall of the orbital cavities. Hanna la characteristic of possessing a small groove, delimited by two ridges, which forms the fossa of the lacrimal sac. They are located in the frontal, the ethmoid and the maxillae.

The nasal bones (plate II n.)

They are two small laminae varying in shape and size, located bilaterally along the median, between the frontal and the maxillaries.

They articulate each other by means of the internasal suture, thus forming a small vaulted shape that follows the protrusion of the nasal septum.

The zygomatic bones (plate II z.)

They are located in the lateral region of the face. Given their ramified conformation into three processes, frontal (fig. D p.f.), maxillary (fig. D p.m.) and temporal (fig. D p.t.), they determine the external and prominent shape of the cheekbones.

The frontal process contributes to the constitution of the lateral wall and the "floor" of the orbit. It articulates above with the zygomatic process of the frontal and posteriorly with the great wing of the sphenoid.

The maxillary process, in continuity with this one in the anterior condition, creates with its lower and lateral limitless orbital margin of most of the circular shape of the orbit.

The temporal process moves backwards, joining the zygomatic process of the temporal bone and thus closing the zygomatic arch.

Fig. A

Anterior front view of the skeleton of the head.

- s. sphenoid
- g.a. large wings of the sphenoid
- 1. superior orbital fissure
- e. ethmoid
- l. lacrimal
- n. nasal
- v. ploughshare
- c. with what
- m. maxillary
- 3. alveolar process
- 4. nasal spine
- z. zygomatic
- ma. mandible

Fig. B

Side profile of the skeleton of the head.

- 2. papyrus lamina of the ethmoid

Detail Fig. B

- ma. mandible
- c. body
- r. branch of the mandible
- 5. alveolar process
- 6. chin protuberance
- 7. angle of the mandible
- 8. Coronoid process
- 9. condyloid process
- 10. mandibular notch
- 11. mandibular tuberosities
- 12. oblique line

Fig. C

Internal and top section of the cranial vault.

- o. occipital

f.o. hole of the occipital
p. parietal
t. thunderstorm
sq. scale of the storm
pe. rocca petrosa
s. sphenoid
f. front
is. ethmoid

Fig D.

Anterolateral view from the bottom of the head.

z. zygomatic

m.p. frontal process of the zygomatic bone
p.m. maxillary process of the zygomatic bone
p.t. temporal process of the zygomatic bone

Fig. E

Detail of the temporomandibular joint

8. Coronoid process
9. condyloid process
10. mandibular notch

Fig. F

Posterolateral view of the skeleton of the head.

a.z. zygomatic arch
m.m. masseter muscle
7. angle of the mandible

The maxillary bones, the vomer, the conches and the palatine bones (plate II m. V. C. Plate I pa.)

The maxillary bones are symmetrically arranged on the midline of the face, thus constituting the central portion, and the largest in the region of the face. They form the greater part of the vault of the buccal cavity, the lateral walls of the nasal cavity and the

"floor" of the orbit. Their body has a convex external face which is more dilated in the lower extremity. This extremity, called alveolar process (figs. AB 3), is arched in shape: wider posteriorly than anteriorly, hollowed out by eight alveoli which house, with shape and width, various roots of the teeth, reserving the deepest alveolus the canine and the larger ones for the molars. When the two jaws are articulated with each other, the alveolar processes together form the alveolar arch. This arch presents on the outside a series of small reliefs corresponding to the alveoli. Among these the greatest relief is due to the so-called canine bag, corresponding to the alveolus of the canine tooth. From the base the upper surface presents a large depression called the canine fossa. From this depressed area the maxilla expands into two robust processes, the frontal and the zygomatic.

The frontal process expands upwards and, like a pillar, transmits the pressures associated with chewing to the frontal bone with which it articulates. The frontal process of the maxillary bone articulates in turn with the lacrimal and the nasal.

The zygomatic process expands laterally, starting from the region of the first molar tooth and articulates with the zygomatic bone becoming a strong base for the zygomatic arch. In the surface between the two processes, the maxilla determines the anterior border or outline of the orbital cavity, also constituting, with its smooth and triangular orbital face, the floor, which thus articulates the nasal bones, the ethmoid and the zygomatic.

The central and medial face opens into the large piriform orifice delimited by the nasal notches, which surround the opening up to the nasal bones and, below, up to the nasal spine (fig. B4). Inside the nasal opening we observe the two nasal cavities separated by the perpendicular lamina of the ethmoid, which articulates at the bottom with the vomer (fig. A v.). On the sides of the two pits we note the basins (fig. A c.) which articulate on the internal walls of the maxilla and the ethmoid. The palatine process (plate I, fig. F p.p.) arises with a concave internal wall from the alveolar process; determines the skeletal vault of the palate, extending posteriorly with the palatine bones.

The bone of the jaw (plate II ma.)

It is the only head bone with joint mobility that completes the lower and anterior shape of the face starting from the base of the cranial vault. It consists of a central body and two lateral branches (detail fig. B).

The body has an arched shape with an anterior convexity, delimited by an upper margin, facing the maxilla, and a lower one, oriented on the glute.

The upper margin is formed by an arcuate alveolar process (detail Fig. B5), corresponding to the same of the maxilla, with the series of sixteen alveoli peri teeth. The body on the inferior medial margin forms the mental protuberance (detail fig. B6), corresponding to the subcutaneous conformation of the chin. On the lower edge the body continues laterally and posteriorly, forming the angle of the mandible (detail fig. B7).

Above the angle, the two mandibular branches are symmetrically paired. These, in the ascending direction, are completed in two processes, an anterior one called the coronoid process (particular fig. B8) and a posterior one, called the condyloid process (particular fig. B9). The two processes are separated by a concave margin called the mandibular notch (detail fig. B10).

The coronoid process is functional to the insertion of the temporal muscle (see table I, fig. C), while the condyloid process and the part of the mandible that articulates in the mandibular fossa of the temporal by means of the flattened spheroidal shape of the condyle, arranged on an axis transverse (figs. D-E).

Below the condyle on the lateral side we can see the masseteric tuberosity (detail fig. B11), place of insertion of the masseteric muscle (fig. F m.m.), and the oblique line (detail fig. B12).

Lesson 27

PROPORTIONAL RELATIONSHIPS AND THREE-DIMENSIONAL HEAD RECONSTRUCTION

In an analysis of the proportions between the skeletal elements of the head (see also lesson 2), we consider the height of a segment (T) as the overall height of the head itself (table I, fig. A). In an anterior frontal view, we will divide the T segment into three parts, obtaining the measurement of $\frac{1}{3} T$; this will correspond to the radius of a circumference equal to the size of the cranial vault (fig. B).

If we divide the segment T in half, the measure of $\frac{1}{2} T$, it will allow us to identify the diameter of a circumference including the dimensions of some parts of the skeletal region of the face (figs. A-B). If we trace two tangent segments to the two circumferences that connect points 1-2 (fig. A) we can define the lateral perimeter of the face (fig. B).

Through successive subdivisions we can obtain further dimensions useful for defining the individual skeletal regions. A horizontal segment that connects points 1-1 (fig. B), allows us to establish the upper limit of the skeletal area of the face (fig. B3). From this point, indicatively from the glabella (fig. B3), we can trace an arched line that connects the upper edges of the orbital cavities up to the lateral limit of the zygomatic process of the front (fig. B4).

In the area included within the intersection of the two circumferences we find the height of the piriform opening of the nasal cavities (fig. B). Thus on the horizontal segment below, tangent to the greater circumference, we can find the alignment of the lower margin of the zygomatic bones (fig. B5).

On the centre of the smaller circumference we find a reference point for the height of the alveolar process of the maxilla (fig. B6). The overall height of the two dental arches can be obtained by dividing the smaller diameter into three parts (fig. B7); finally,

dividing in half the radius of the smaller circumference, we find the height values corresponding to the angles of the mandible (fig. B8).

If we observe the head in its lateral profile (fig. C), we notice how the ovoid shape of the skull corresponds to an ellipse. To determine the proportions we can inscribe it in a rectangle (fig. E), where the smaller side, height of the skullcap, is equal to the diameter of the larger circumference (fig. D). The larger side, on the other hand, can be obtained by dividing the diameter of the larger circumference into three parts (fig. D); this fraction is added to the measure of the diameter, that is $d + \frac{1}{3}d$, and from the measure of the greater side.

This measure of depth of the head goes from the anterior region of the glabella to the point of posterior intersection between the sagittal suture of the parietal bones with the lambdoid suture of the occipital (Fig. C 3-9). This elliptical perimeter (fig. F) will then be oriented with an inclination of five degrees with respect to the perpendicular line of the axis that crosses the skull in its half (fig. G).

It is obvious that the ellipse identifies an indicative perimeter, since the shape of the skull in the occipital region denotes greater dilation in the lower posterior part (fig. C).

Let us now analyse the shape of the head in relation to its volume (table II). We can indicatively identify a prismatic shape for the volumes of the face, and an ovoid shape for the skull.

The prismatic shape of the skeleton of the face thus finds an oblique plane of intersection (plate II) with the skull, which we will call indicatively plane b., As the base or "floor" of the skull vault, useful for a graphic reconstruction, as can be note from table III. This plane is determined by an ideal section line that passes through the glabella (figs. A-B3) and, following the upper arched margin of the orbits, reaches the zygomatic process of the frontal (fig. A-B4) and from this, leaning, it moves posteriorly along the temporal fossa (pl. II, ft), up to the temporomandibular joint (figs. AB 11).

Table I

Fig. A

The modular relations of the head.

T head module.

- 1-2. points of tangency of the segment that defines the lateral perimeter of the face

Fig. B

Anterior frontal view of the skeleton of the head seen in its proportions.

3. glabella
4. frontal zygomatic process
5. inferior margin of the zygomatic bone
6. alveolar process of the maxilla
7. alveolar process of the mandible
8. angle of the jaw
- 10 tuberosita chin or angle of the mandible

Fig. C.

Side profile of the skeleton of the head.

11. temporomandibular joint condylar process
9. Lambdoid suture of the occipital

Figs. D-E

Modular scheme of the head.

d. larger circumference diameter

Fig.F

Geometric construction of the ellipse comparable to the perimeter of the cranial vault.

F ' - F ". Foci of the ellipse

Fig. G.

5 ° inclination of the construction ellipse of the cranial vault and 10 ° inclination of the mandible branch.

Fig.H

Complete reconstruction of the cranial vault.

Table II

Figs. A-B

Frontal and lateral view of the head with identification of plane b passing through the following points.

- 3. glabella
- 4. frontal zygomatic process
- 11. temporomandibular joint

Identification of the edges of the prismatic volume of the face.
Front margin:

- 4. zygomatic process
- 10. Chin protuberance

Posterior margin:

- 11. temporomandibular joint
- 8. angle of the mandible

Example of structural reconstruction of the head with anterolateral viewpoint.

Table III

Fig A.

We can see the foreshortening of the sagittal section of the head

with the intersection of the inclined segment b. (trend line of the same plan).

Fig. B

We visualise the plane b which will define us the "floor" of the skull which starting from the glabella (B3) with an arched course up to the zygomatic process of the frontal (B4) then moves obliquely down to the temporomandibular joint (B11) and then proceed posteriorly closing on the curvilinear course of the inferior line of the occipital bone.

Fig. C

From plane b we determine the trajectories that allow us to identify the overall and schematic volume of the skeleton of the face: from the frontal zygomatic processes (C4) to the anterior angle of the mandible (C10) and from the temporomandibular joint (C11) to at the angle of the mandible (C8). We can also identify two segments belonging to the plane that starting from point 3 lead to point 11 thus creating a triangle, in whose vertices (points f) we identify the points of maximum depth of the orbital cavities corresponding to the superior orbital slits.

Fig D.

From points f with two arcuate lines we can define the posterior plane of the maxillary bone, of the dental arches and of the mandibular body. From these "guide" points of the essential volumes we can proceed to a greater definition of the morphology of the head.

Lesson 28

THE SKELETON OF THE UPPER LIMB

The upper limb, in its three segments consisting of arm, forearm and hand, is equipped with highly specialised joint mechanisms that ensure that agility and dynamism of movement that are indispensable to the function of grasping.

The bones of the upper limb are therefore lighter than those of the lower limb, whose primary role is to support the weight of the body and to allow locomotion.

The articulations of the superior ape also allow to move the segment of the hand within the visual field of man, subjecting every manual function to the constant control of the stereoscopic vision of our eye.

The skeletal structure (Table I) which makes up the upper limb and, as in the lower limb, divided into four segments:

- the skeleton of the shoulder, formed by the clavicle (c.) and scapula (s.)
- the skeleton of the arm, formed by the humerus (o.)
- the forearm, consisting of radius (r.) and ulna (u.)
- the skeleton of the hand, composed in turn of the three segments of the carpus (ca.), metacarpus (m.) and phalanges (f.).

Table I

The skeleton of the upper limb in relation to the totality of the figure.

- c. clavicle
- s. scapula
- o. humerus

r. radio
u. ulna
ca. carpus
m. metacarpus
f. phalanges

Lesson 29

THE SKELETON OF THE SHOULDER

It is composed of two skeletal elements: the clavicle (pl. I, figs. A-B-C c.) And the scapula (pl. I, figs. A-B-C s.).

They are connected to each other through a flat joint (fig. A1) and form the shoulder girdle. The latter defines the skeletal perimeter of the shoulder plane and is a sort of skeletal arch that connects the upper limb to the trunk. The connection of the shoulder girdle to the trunk occurs through the joint between the clavicle and the sternum, called the sternoclavicular joint (fig. A2). This is, incidentally, the only "skeletal" link; in fact the scapula, articulated with the clavicle, and supported only by this; being thus "suspended", it relates to the rib cage only through a system of movable tie rods such as muscles.

The scapula articulates with the head of the humerus through an osteoarthritis (fig. A3), a very mobile ball joint, which allows the upper limb an extremely large degree of movement, which is in turn amplified, as we will see later. in detail, from the mobility of the articular device of the track itself.

If we now compare the shoulder girdle with the pelvic girdle or pelvis, we can better understand the similarities and differences due to the different functions that the upper and lower limbs of the human body are assigned to.

The articulation of the scapular girdle with the axial skeleton takes place in the sternum: it is placed anteriorly (see fig. C) and, being mobile, allows movements such as the elevation and lowering of the shoulder and the anterior and posterior advancement of the shoulder itself. . In the pelvis, the joint with the axial skeleton occurs in the sacrum; and fixed, rear (see fig. C) and is made up of particularly sturdy and bulky elements, designed to withstand mechanical stresses. On the contrary, the shoulder girdle is made up of basically light skeletal elements, suited to the needs of

movement.

The joint with enarthrosis in the iliac bones occurs in the acetabulum (Fig. A4); this deep cavity accommodates a large part of the femoral head and therefore allows for limited amplitude movement. In the case of the scapula, on the other hand, its glenoid fossa (figs. A-C3), by means of which it articulates with the humeral head, and even almost flat; consequently much of this joint is supported by the ligaments, especially by the deep muscles of the shoulder. This combination thus allows very large joint movements.

Table I

Fig. A

Anterior frontal view of the skeleton of the trunk, head e of the shoulder, seen in their proportions.

- T head module
- c. clavicle
- 1. articulation acromion clavicolare
- 2. sternum clavicular joint
- st. sternum
- m.s. manubria the sternum
- s. scapula
- to. acromion
- 3 glenoid cavitit
- o. humera
- t.o. head of the humerus
- 4. acetabulum

Fig. B

Front rear view.

Fig. C

Side view.

Lesson 30

THE CLAVICLE AND THE SCAPULA

Let us now observe in detail the two skeletal segments that form the shoulder girdle, the clavicle and the shoulder blade (plate I).

The collarbone

Given its long and slender body, the clavicle belongs to the category of long bones; and placed anteriorly with respect to the thoracic cage and articulates in the medial extremity with the sternum and in its lateral extremity with the acromion of the scapula.

The body is characterised, in an observation of the shape from above (fig. B), by an S-shaped trend and it is on the basis of these two opposing curvatures that the clavicle is modeled to the shape of the chest (see fig. H) . In its medial portion the body is slightly rounded, while in the lateral portion it becomes more flattened from top to bottom, until it joins the joint with the scapula.

The sternal end (figs. A-B1) is facing the sternum handlebar; and equipped with a sternal articular face (fig. A2) and this articulates with the clavicular notch of the manubrium (fig. H). This end above the articular facet expands into a pyramidal and voluminous shape; in this way it makes the epidermal depression of the suprasternal dimple characteristic (fig. H) which is formed between the two reliefs of the articular extremities of the clavicle in the anterior base of the neck.

The acromial end (figs. A-B3) is flat and articulates with the acromion by means of an elliptical facet, called the articular face acromial (fig. A4).

The shape of the clavicle is evident at the epidermal level along the

stretch that goes from the handlebars to the scapula, thus becoming a recognisable and orienting element in drawing exercises from the nude.

The scapula

It is a flat, triangular-shaped bone with the short ilium facing upwards to form the upper margin; it thus has two faces, one anterior and one posterior, three margins and three corners.

The anterior or costal face (fig. E), concave, faces the posterior and convex wall of the rib cage. This face is hollowed out and crossed diagonally by ribs or ridges which offers the point of attachment to the vast muscle called the subscapularis which it largely covers. Given the origin of this muscle, this depressed face is called the subscapular fossa.

The slightly convex posterior or dorsal face is characterised by the skeletal element in relief called the spine (fig. C). The spinae is made up of a triangular lamina called trine (fig. C1), a crest (fig. C2) and the acromion (fig. C3). The lamina or trine, similar to a shelf, protrudes obliquely from the posterior face; the anterior margin of the lamina is fused with the dorsal surface of the scapula and in this way divides it transversely into two areas. This division creates two distinct surfaces: an upper one, called the supraspinatus fossa, and a lower and percic) larger delta infraspinatus fossa.

Il margine laterale continua in basso con l'angolo inferiore e da questo comincia il margine mediale (figg. C-E m.m.), che si estende verso l'alto sino all'angolo superiore; da questo punto, il pili alto della faccia dorsale, parte il margine superiore (figg. C-D-E m.s.). Quest'ultimo, SOfte e aguzzo, e più breve degli altri e si porta in direzione della cavita glenoidea.

Table I

Fig. A

Front anterior view of the clavicle.

- c. body
- 1. sternal extremity
- 2. sternal articular face
- 3. acromial tip
- 4. acromial joint face

Fig. B

Top view of the clavicle and of the acromial process.

- c. body
- a. acromial process of the scapula

Fig. C

Posterior Frankish view of the triangular lamina of the scapula

Scapula

- 1. trigone plug
- 2. crest of the spine
- 3. acromial process or acromion
- 8. Coracoid beak
- m.l. lateral margin
- m.m. medial margin
- m.s. top margin

Fig D.

Glenoid cavity lateral profile view

Fig E.

Front front view

- 4. acromial joint facet

Fig.F

Volumetric views of the scapula from different points of view.

6 supraglenoid tubercle

7 infraglenoid tuberosity

Fig.H

Volumetric view of the shoulder girdle.

f.s. suprasternal dimple

c. clavicle

s. scapula

Fig. G.

Proportional ratios of the scapula and clavicle. F corresponding modular proportional ratio; to the height dimension of the face

f.s. suprasternal dimple

1. trine of the spine

t.o. head of the humerus

Proportional ratios of the scapula (fig. G) The height of the shoulder blade corresponds to the measurement of the submodule of the head F, ave Fe given by T-1 I 6T (see also lesson 2). If we divide this underside of the face into four equal parts, we can identify the origin of the trine of the spine (fig. G1) on the first upper quarter.

The width of the scapula from the medial margin to the glenoid cavity is given by $\frac{1}{2} F$, while its field width, including the acromion spread, is given by $\frac{1}{2} F + \frac{1}{4} F$.

Lesson 31

CLAVICLE AND SCAPULA IN THEIR JOINT RELATIONSHIP WITH THE RIB CAGE

To identify and volumetrically reconstruct the joint relationship between clavicle and scapula in their "support" on the ovoid volume of the thoracic cage, we can resort to identifying a structure, a sort of "primary frame", which allows the essential construction of the "plane" of the shoulders (Plate 1), formed anteriorly by the clavicle, laterally by the acromial process and posteriorly by the crest of the spine of the scapula.

To understand the structural trends of the shoulder plane, we must recover the relationship of this plane with the oblique plane identifies the upper orifice of the rib cage. We will thus determine a transversal segment which, finding original from the centre of the plane of the superior orifice (table I, figs. CB sgg. O), will be brought laterally to the point of joint connection between the clavicle and the acromion of the scapula (figs. AB sgg., point 1)

We now draw two more segments in relation to the previous one, one anterior and one posterior. The anterior originates from the clavicular notch (figs. A-B sgg., Point 2) and moves to the acromioclavicular joint tip (figs. A-B sgg., Point 1), thus identifying the trajectory of the clavicle in its course. The posterior allows us to orient the alignment of the scapula with respect to the thoracic cage and originates from the costal angle of the 1st rib (figs. AB ff., Tip 3) and is directed laterally on the depth of the acromial process (figs. AB ff. , tip 4). From this process we trace the segment that indicates the inclined development of the crest of the spine of the scapula, up to! medial margin of the scapula itself (figs. B-C-D-E 5). This, in turn, coincides with the costal angle, lateral margin of the pulmonary shower. In this way, the limit of the skeletal perimeter of the shoulder girdle is defined as visible epidermally.

To this set of tracings that allow to highlight the margin or upper perimeter of the shoulder plane, we can add two segments, one

anterior (p.a.) and one posterior (p.p.), which originating from the section plane of the rib cage at the sternum and, joining acromial process, set the indicative trajectories of the two muscle pillars (see figs. A-B-C and volumetric developments) that form the axillary cavity (see lessons dedicated to the muscles of the trunk and shoulder). The ensemble of the construction thus obtained highlights the prismatic volume of the shoulder in its relation to the ovoid volume of the rib cage.

Table I

Fig. A

Frontal view of the rib cage and shoulder girdle. Study on the structure layouts of the shoulder plan.

- c. clavicle
- s. scapula
- a. acromion
- o. centre orifice upper rib cage
- 1. Point of articulation between scapula and clavicle (acromio clavicular)
- 2. articulation tip between sternum and clavicle manubria (sternoclavicular)
- 3. costal angle of the 1st coast
- 4. angle of the acromion with the crest of the spine of the scapula

Fig. B

Side view.

- 5. Medial angle of the scapula

p.a. anterior pillar

p.p. posterior pillar

Fig. C.

Front rear view.

Fig. D-E

Top view.

Fig. F

Detail of the shoulder blades aligned on the transverse axis.

Figs. G-H-1

Volumetric studies highlighting the spatial construction trajectories of the shoulder girdle and of the plane that defines the anterior and posterior margin of the axillary cavity and of the shoulder joint in its intersection with the ovoid shape of the rib cage.

t.o. head of the humerus

Lesson 32

THE UPPER LIMB THE SKELETON OF THE ARM AND FOREARM

The arm (Table I) corresponds to the skeletal segment of the humerus (fig. B o.). The humerus is a long bone; it has a shaft and two articular ends. The upper extremity is composed of a hemispherical articular head (fig. B1); this connects to the scapula in the glenoid cavity (fig. B2), and forms the shoulder joint, the scapula humeral, which is an extremely mobile joint with enarthrosis.

The diaphysis (fig. B3), of prismatic shape, is characterised by impressions for the grafting of the powerful muscles delegated to the movement of the arm. The lower extremity is composed of two articulating surfaces: the trochlea (fig. B4) and the condyle (fig. B5).

These connect to the ulna (fig. B u.) And the radius (fig. B r.), Giving rise to the elbow joint, composed of the humero-ulnar joint between the trochlea and the trochlear face of the ulna, to the humero-radial articulation between the condyle and the upper face of the capital (fig. B6) of the radius, which thus generate a movement of flexion and extension of the forearm on the arm.

The forearm is formed by the two long bones of the radius and ulna which not only concur with their upper extremity to form the elbow joint but, through the radial head and the radial notch of the ulna (fig. B7) they also find their reciprocal joint relationship called superior radio-ulnar. Their prismatic diaphyses are arched to the lower extremity, where, unlike the upper extremity in which it is thinner, the radius is more massive and covers with its transverse volume almost the entire joint of the joint. of the wrist. In fact, the radius and the skeletal segment delegated to the joint function with the carpus (fig. B c.) Of the hand (radio-carpal joint), constituting its main support.

The ulna, in its lower extremity, is characterised by an articular

head (fig. B8), which does not perform direct articulation tasks with the hand, but with which it connects to the radius in the ulnar notch (fig. B9) forming the inferior radio-ulnar joint. This joint, together with the superior radio-ulnar joint, allows the radius to perform a rotational movement on its longitudinal axis, called pronation (see figs. C-D-E-F), thanks to which the radius overlaps the ulna by crossing it, and to supination (fig. B), when the two segments are in a condition of parallelism. In these movements the radius carries the hand with it, thus turning the palm from anterior (supination movement) to posterior (pronation movement) and the humerus slightly contributes to this movement with a rotation on its own axis (see figs. C-E-F). The ulna in these movements thus fulfils an indispensable role of mechanical support. In fact, since the ulna is the skeletal element most responsible for the articular mechanics of the elbow which involves uniaxial movements of extension and flexion due to its connection with the trochlea of the humerus, it carries the radius with it in these movements. In fact, the connection between radius and condyle, that is, between flat and spherical surfaces, is more mobile but also weaker in itself.

Table I

Fig. A

Upper limb: anatomical axes and mechanical rotation axis of the skeleton and modular proportional ratios.

- O modular ratio corresponding to the skeletal segment of the humerus: $(T + 1/3 T) = O$
- F modular ratio equivalent to the height dimension of the face: $(T - 1/6 T) = F$

Fig. B

Anterior front view in extension and supination of the hand of the right upper limb.

- s. scapula

- o. Humer
- 1. head
- 2. glenoid cavity of the scapula
- 3. diaphysis
- 4. trochlea
- 5. condyle
- r. radio
- 6. capital of the radius
- u. ulna
- 7. radial notch of the ulna
- 8. head
- 9. ulnar incisure of the radius
- c. carpus

Fig. C

Right upper limb, anterior front view
Hand pronation movement.

Fig. D-E

Frontal view, detail of the right upper limb.

Fig. F

Frontal rear view - detail of the right upper limb.

o. olecranon

These initial indications help us to understand both the behaviour of the anatomical axes intrinsic to the progress of the single diaphysis, and that of the main mechanical axis and of the single dimensional relationships between the various parts. In the example (figs. A-B), we propose the upper limb lowered in extension and supination.

To find a correct orientation, we note that, with respect to a vertical axis (anatomic axis) passing through the centre of the articular head of the humerus (fig. A) and intrinsic to the longitudinal course of its diaphysis, the two diaphyses of the forearm, radius and ulna (figs. A-B) are initially located in alignment with this axis, but forming a lateral open angle with the humerus.

This displacement of the lateral radius and ulna shaft satisfies two different conditions. On the one hand, it ensures that, in the pronation movement, the radius brings the man in line with the diaphyseal axis of the humerus (figs. CEF), a normal situation in the posture of the upper limb in a resting condition of semipronation, that is of near complete pronation (fig. D). On the other hand, it allows the ulna, in the flexion movement, to overlap the humerus, thanks also to the angular value of the transverse axis of the elbow joint, placed perpendicular to the mechanical axis of rotation (fig. A).

The axis of rotation originates in the centre of the humeral head (fig. A1) and moves outside by five degrees with respect to the diaphyseal axis of the same, passing through the condyle (fig. A5) until it contracts, in the median, the capital of the radius (centre of rotation) and, below, the lower radio-ulnar joint (Fig. A9). The pronation and supination movements take place on this axis of rotation.

By evaluating the proportional ratios of the skeletal parts examined (fig. A), we can note that generally the humerus is equal in length to the forearm plus carpus and metacarpus. Here we propose (fig. A) a proportional subdivision through segment F, submodule of module T (head), which, as we have already seen, corresponds to the measurement of the face.

Lesson 33

THE SKELETON OF THE ARM: THE HUMERUS

The humerus (Plate I) and the skeletal segment of the arm that goes from the shoulder to the elbow; It is a long bone and is composed of a body or shaft and two articular ends, one upper and one lower. The upper extremity has an articular head and two tubercles, major and minor.

The head (figs. A-B-C1) is hemispherical in shape and is turned, medial and posterior, to the glenoid cavity of the scapula with which it articulates.

The articular area of the head is surrounded by a short depressed area delta glue (figs. A-B-C2), in which the fibrous capsule is inserted which incorporates the articular head inside and which originates from the edge of the glenoid cavity; starting from the glue we can see the two reliefs of the tubercles. II major (figs. A-B-C3), placed sideways, and the most protruding point of the upper extremity. The tubercle, by means of three facets, of the impressions, (figs. BF f.) Offers the points of insertion to three muscle bundles that originate from the dorsal face of the scapula and are, in the order of insertion from anterior to posterior, the supraspinatus, infraspinatus and small rotunda.

The minor tubercle (figs. A-B 4) is also equipped with an imprint (figs. A-B-F f.), Into which the subscapularis muscle originating from the so-like face of the scapula is inserted. In addition to the fibrous capsule, and above all thanks to the action of this set of muscle bundles, the joint head of the humerus, during movement, is constantly kept in contact with the glenoid joint cavity of the scapula, thus securing the segment of the arm to the shoulder.

The two tubercles are separated anteriorly by a longitudinal groove of the bicipital shower (figs. A-B5), in which the long tendon of the biceps long head muscle runs.

The diaphysis, starting from below the tubercles, denotes a

cylindrical section and shows laterally, just above its goal, a vast elliptical and wrinkled area delta deltoid imprint (figs. AB-C6), place of insertion of the muscle of the same name which, with its volume, characterises the lateral margin of the shoulders. Starting from the impression and downwards, the cylindrical section of the diaphysis progressively transforms into a markedly triangular section, thus presenting three faces and three margins.

Of the latter, the two lateral and medial ones, as the shape downwards widens transversally and flattens anterior-posterior sense, become sharp and are also called lateral supracondylar ridges respectively (figs. AB-C7) and medial supracondylar (figs. A-C8). These margins expand into two protrusions called the epicondyle, placed laterally (figs. ABC 9), and epitrochlea, placed medially (figs. AC 10). These, together with the supracondylar crest, are the places of origin of the forearm and hand muscles. .

The lower extremity is characterised by two articular surfaces for the skeleton of the forearm, namely the trochlea, which articulates with the skeletal segment of the ulna, and the condyle, which articulates with the radius segment.

The trochlea (figs. A-C11) and placed medially below the epitrochlear projection; and an articular shape similar to a pulley, characterised by two surfaces of a truncated cone shape joined centrally with their "minor bases" and arranged on a horizontal transverse axis.

This form articulates with the trochlear articular face of the ulna (see Fig. D12). Next to the trochlea we find the spheroidal protrusion of the condyle (figs. A-B-C 13) which articulates with the concave upper face of the head of the radius.

Anteriorly, above the trochlea, we notice a depression called the coronoid fossa (figs. A-E14); this receives the coronoid process of the ulna when the forearm is in its condition of maximum flexion (see example Fig. G); posteriorly, above the trochlea, we find another depressed and deeper area called the olecranon fossa (figs. C-E 15); this receives the olecranon notch of the ulna when the forearm is in the position of maximum extension.

We can note that also above the condyle there is a so-called radial

fossa (fig. A16), much less depressed than the others, which serves to contain the head of the radius in the moment of maximum flexion (see fig. G).

Table I

Fig. A

Anterior frontal view of the right spine.

1. head
2. neck
3. greater tubercle
4. minor tubercle
- f. facets for the insertion of the muscles of the scapula
5. bicipital shower
6. impression of the idea
7. Supracondylar crest, terminal part of the lateral margin
8. Supracondylar ridge - terminal part of the medial margin
9. epicondyle
10. epitrochlea
11. trochlea
13. condyle
14. coronoid fossa
16. radial dimple

Detail Fig. A Lower extremity of the humerus, view from below.

Fig. B

Side view.

Fig. C

Front rear view.

15. olecranon fossa

Fig. E

Elbow joint seen from the front and in longitudinal section.

14. Coronoid fossa of the humerus

p.c. Coronoid process of the ulna

15 olecranon fossa

b.o. beak of the olecranon

Fig D.

Volumetric view of the skeletal parts that make up the elbow joint.

11. schematic view of the trochlea of the humerus

u. ulna

b.o. beak of the olecranon

p.c. Coronoid process of the ulna

12. semilunar facets of the trochlear articular face of the ulna

Fig.F

Top view of the right upper limb seen in the semi-pronation movement.

or. Humer

1. head

2. glue

3. greater tubercle

f.p. facet for the muscle

f.in. small round facet for the muscle

f.s. infraspinatus facet for the supraspinatus muscle

4. minor tubercle

f.sub. facet for the subscapularis muscle

5. bicipital shower

r. radio

u. ulna

c. carpus

m. metacarpus

f. phalanges

Fig. G.

Left and right upper limbs seen in the flexion movement

Lesson 34

SHOULDER JOINT

This enarthrosis joint is due to the hemispherical head of the humerus which articulates on the slightly concave surface of the glenoid fossa of the scapula. In this joint, the articular surface of the humeral head is much more extensive than the cavity itself (Plate I, fig. A1); consequently only a small portion of it, in the movement phase, comes into contact with the surface of the cavity itself; this explains the range of motion that the arm can make on the shoulder.

The humeral head is held in place by a series of ligaments: a fibrocartilaginous ring (called the glenoid lip), the fibrous capsule, the glenohumeral ligament, the coraco-humeral, the humeral-transverse. We focus on the first two.

The labrum originates from the edge of the joint area of the glenoid cavity and in this way expands the area itself, making it deeper and more congruent to the humeral head.

The capsule (fig. B2) completely envelops the two articular surfaces originates from the contour of the glenoid cavity (fig. B3), including the upper lip inside it and is inserted into the humerus neck (fig. B4). Since this fibrous capsule allows a very wide range of movements, it is loose and lax; in this way the real elements that hold the head of the humerus in the joint are the muscles of the shoulder - mentioned in the previous lesson - which also, with their tendon tracts, partially fuse with the joint capsule, strengthening it. This articulation allows the arm an infinite variety of movements which can still be grouped into these categories: flexion and extension, abduction and adduction (fig. F), internal rotation and external rotation plus an overall movement called circling.

We must underline that the amplitude of the movements of the arm is considerably increased by the concomitant action of the shoulder girdle; in fact, the skeletal segment of the clavicle, pivoting on the sternum handle in the sternoclavicular joint, drags the scapula along with it in movement, which slides on the convex

wall of the thorax; consequently the scapula can move upwards (see figs. C-D), facilitating the movement of the arm upwards, or it can rotate forward (fig. E1), allowing the arms to cross anteriorly or posteriorly (fig. E2). As an example of this very close relationship between the two joints, we can analyse the abduction movement of the arm (fig. F). This is possible, up to placing the arm from a vertical position (fig. F1) to a horizontal position (fig. F2), involving only the scapulohumeral joint, while a further lifting (fig. F3) involves the articulation of the clavicle with the sternum. This is due to the skeletal bridge formed by the acromion (fig. B5), the coracoid beak (fig. B6) and the coraco-acromial connection (fig. B7), stretched between these two skeletal emergencies.

This set of elements thus limits the range of movement of the arm segment upwards and makes it necessary to perform joint intervention on the shoulder girdle.

Table I

Fig. A

Detail of the shoulder joint.

- o. humerus
- 1. articular head of the humerus
- s. scapula (joint end)

Fig. B

Detail of the shoulder joint.

- 2. joint capsule
- 3. contour of the glenoid cavity
- 4. humerus neck
- f.sott. facet for insertion of the subscapularis muscle
- f.s. facet for insertion of the supraspinatus muscle
- f.i. facet for the insertion of the infraspinatus muscle
- 5. acromial process
- 6. Coracoid notch

7. Coracoacromial ligament

Fig. C.

Posterior front view of the elevation movement of the shoulder girdle.

1. sternoclavicular joint

Fig D.

Postero-lateral view of the shoulder girdle and details of the shoulder blade elevation movement.

Fig. E

Superior view - rotational movements of the shoulder girdle.

1. front rotation
2. rear rotation

Fig. F

Sequential anterolateral view of the articular mechanics of the shoulder girdle and the articulation of the scapula in its relation to the abduction movement of the arm.

Lesson 35

THE FOREARM SKELETON: THE ULNA AND THE RADIUS

The bones of the forearm, ie the radius and ulna (Plate I), constitute the skeletal segment that extends from the elbow to the wrist; they assume an arrangement parallel to each other and slightly oblique with respect to the course of the shaft of the humerus (see also lesson 32).

The ulna

the ulna is the medial bone of the forearm; and a long bone and as such characterised by a diaphysis and two articular ends, upper and lower. The upper extremity develops in a voluminous process of prismatic shape, delta olecranon (table I, figs. B-C1); this anteriorly presents a vast excavated area, the trochlear articular face (fig. A2), which is delimited at the top by a protruding process in the shape of a hook, called the beak of the olecranon (fig. A3). The beak gives rise to a central relief called crest (figs. AB 4), which divides the trochlear face with its progression from top to bottom, thus determining in turn two distinct faces, called semilunar notches (fig. A is) . The crest ends anteriorly in a protrusion called the coronoid process (figs. A-B5), which constitutes the anterior margin of the trochlear articular face. This articular face of the ulna, joining the arctic surface of the humerus, gives rise to the humero-ulnar joint, a ginglimo diarthrosis angular. These two surfaces, articulating, determine a flexion and extension movement of the ulna on the humerus (see Fig. F). the ulna presents a small concave articular facet lateral to the trochlear articular surface, called the radial notch (fig. B i.r.), through which the ulna articulates with the radius, the superior or proximal radio-ulnar joint (see detail Figs. A-B). Below these two articular surfaces the shape of the ulna reveals two wrinkled areas. The first, triangular in shape and paste anteriorly, slightly below the coronoid process, clarified ulnar tuberosity (fig. A6), constitutes the tip of insertion of the brachial muscle. The second, lateral and smaller pasta, is characterised by a groove from which the supinator muscle originates (fig. B7).

Starting from the expanded and voluminous superior area, the diaphysis progressively tapered and its prismatic shape, with a quadrangular section at the level of its olecranon process (see particular fig. A), always becomes more triangular in the portion median, while downwards, in proximity of its extremity lower, assumes a cylindrical shape.

The lower extremity is more dilated than the diaphysis and is stopped by a cylindrical articular head (figs. ABC t.u.) with a smooth surface, where it will find the possibility of articulating the lower extremity of the radius (inferior or distal radio-ulnar joint). It should be noted that in the posterior end of the articular head there is a small pointed apophysis, the styloid process (Figs. B-C8). This raised shape creates a groove called the styloid sulcus (Figs. B-C9), which guides the tendon of the extensor carpi ulnar muscle.

Table I

Fig. A

Frontal view of the skeleton of the forearm.

- u. ulna
- 2. trochlear articular face
- 3. base of the olecranon
- 4. crest
- i.s. semilunar notch
- 5. Coronoid process
- 6. ulnar tuberosity
- m.l. lateral margin
- t.u. articular head of the ulna
- l.t. triangular ligament
- r. radius
- c.r. capital of the radius
- 10. neck
- 11. radial tuberosity
- m.m. medial margin
- 12. crest
- 13. styloid process

- i.u. ulnar notch
- 14. articular lower face of the radius

Detail fig. A

Superior radio-ulnar joint: section of the ulna at the level of the radius head

- i.r. radial notch
- f.a. upper articular facet of the radius capital

Fig. B

Lateral view of the ulna.

- 1. olecranon
- i.r. radial notch
- 7. ulnar tuberosity or crest of the supinator muscle
- 8. styloid process
- 9. styloid sulcus

Detail fig. B.

Superior radio-ulnar joint: anterolateral view of the ulna (in section) and the radius head

- 6. tuberosity of the ulna

Fig. C.

Front rear view.

- u. ulna
- r. radius
- c. carpus

Detail fig. C.

Inferior radio-ulnar joint: anterior frontal and bottom view of the articular movement of supination and pronation of the radius.

Fig D.

Details of the elbow joint.

Fig. E

Details of the elbow joint. Bending movement at right and acute

angles from various points of view.

Fig. F

Elbow joint Antero-medial view of the left upper limb in flexion.

Figs. F'-F''-F'''

Elbow joint: Antero-medial view of the left and right upper limbs (F'). Radius ulna flexion on the humerus and supination and semipronation movement of the radius on the ulna.

Fig. G

Anterolateral view of the left upper limb in right angle flexion and semi-pronation of the radius.

m.i. interosseous membrane

u. ulna

i.s. semilunar incisions

i.r. radial notch

The radius

The radius is located laterally to the ulna and also consists of a body and two extremities, upper and lower.

The upper extremity is characterised by a small cylindrical articular head which is also called the capital of the radius (figs A-C c.r.). This smooth-surfaced head results in two distinct joints.

The first, called radial humerus, occurs in the head of the radius which has a concave and smooth articular face (see detail Fig. A f), which is modeled on the spheroidal and convex shape of the condyle of the humerus (see Fig. D and fig. E). This spherical joint allows in turn two types of movement: the prime and flexion and extension, since, with its concave upper face, the radius slides on the surface of the condyle (fig. E), thus bringing the flexion closer in flexion. segment of the radius to the humerus; the second movement is instead of rotation, since this same concave face allows the radius to rotate along its longitudinal axis.

The second joint is called superior or proximal radio-ulnar; The

cylindrical head of the radius rotates on its own axis, sliding in the concave depression of the radial notch of the ulna (see particular figs. A-B). The head of the radius is held in its seat by the annular ligament (detail fig. A); this ligament inserts itself at the margins of the radial notch, forming a ring within which the radius exercises its rotational movement.

Below the capital of the radius and after a short cylindrical cell (fig. A10), the diaphysis has a wrinkled elliptical shape, the radial tuberosity (fig. A11), the area of insertion of the biceps muscle from which the diaphysis progressively becomes it widens and from cylindrical it becomes triangular, thus denoting three faces and three margins. Of these, the particularly sharp medial margin (fig. A m.m). offers the attachment to a lamina, the interosseous membrane (fig. G m.i.), which from the medial margin of the radius leads to the lateral margin of the ulna (fig. A m.l.), forming a plane that joins the two long bones of the forearm (see fig. G). The deep anterior and posterior muscles of the forearm originate from this additional plane. The diaphysis, characterised by a triangular shape, has a slightly arched downward movement with a lateral convexity. In its lower extremity, the diaphysis widens considerably, increases in volume occupying a large part of the space from the wrist, and its triangular shape becomes quadrilateral thus presenting four faces. The anterior face is characterised by a robust crest (fig. A12) and is thicker laterally than medially. The dorsal or posterior face is hollowed out by four longitudinal furrows (fig. C) which create the containment showers of the tendons of the forearm muscles. The lateral face shows a bulky and downward protruding relief, the styloid process (figs. A-C 13). The medial face is characterised by a small grooved area, called the ulnar incisure (fig. A i.u.), which articulates with the cylindrical head of the ulna. This joint, called inferior or distal radio-ulnar, where the radius rotates on the head of the ulna (particular fig. C), combined with the superior radio-ulnar joint, brings the radius segment, in rotation, to overlap the segment schema of the ulna (see also table II, fig. F). This overlapping movement, in which the radius carries the hand with it, is called pronation and thus leads the palm of the hand to be turned from anterior (supination movement) to posterior (pronation movement) (see fig. F "") , thus allowing that rapid overturning of the hand itself which is the basis of its extreme mobility. The radius articulates with the carpal

bones (figs. AC c.) In the lower face (fig. A14), characterised by a concave and smooth surface, consisting in turn of two articular areas, separated by a slight crest, which articulate with the carpal bones of manus, that is, with the navicular and lunate. This joint is called radiocarpal.

Tav. II

Figs. A-B-C

Right upper limb in lateral view: sequence of movement (supination, semi-pronation, pronation).

Fig D.

Figure in profile with the upper limb in the movements of:

1. Flexion of the arm on the shoulder, extension of the forearm on the upper arm and of the hand on the forearm
2. flexion of the arm on the shoulder and extension of the forearm on the arm with semi-pronation of the hand
3. flexion of the arm on the shoulder, flexion of the forearm on the arm, dorsiflexion and palmar flexion of the hand on the forearm.

Fig.E

Flexion of the forearm on the upper arm with pronation of the hand.

Fig.F

Extension and flexion of the forearm on the upper arm with hand pronation.

Fig. G

Studies on the volume of the hand.

Lesson 36

THE SKELETON OF THE HAND AND THE CARPUS

The skeleton of manna (Plate I, fig. A) is composed of three segments: the carpus, corresponding to the region of the wrist, the metacarpus, corresponding to the region of the palm, and the phalanges, corresponding to the fingers of the hand.

The carpus (fig. B) is a set of eight small short bones joined in a reciprocal joint relationship and arranged in two superimposed rows. The superior or proximal row is formed by the scaphoid (fig. B1), the lunate (fig. B2), the pyramidal (fig. B3) and the pisiform (fig. B4). The lower or distal row is composed of the trapezoid (fig. B5), the trapezoid (fig. B6), the capitate (fig. B7) and the uncinat (fig. B8).

Taken as a whole, the form (fig. A) shows an arched upper margin, a serrated lower margin, which interlocks with the metacarpal bones, and two faces, the anterior or palmar, which is concave, and the posterior or dorsal, convex.

The four bones of the proximal row constitute the superior margin; this, of arched and semicircular shape, more dilated in the transversal sense, was with its shape a skeletal arch consisting of scaphoid, semilunar and pyramidal, which, by means of their articular faces, connect to the concave articular face of the radius. This arched shape thus allows the radiocarpal joint a large degree of flexion, extension, adduction, abduction movement and an overall circling movement of the manna on the forearm.

The articular surface of the carpus consists mainly of the particularly convex articular faces of the scaphoid (fig. C1 f.a.) and the lunate (fig. C2 f.a.); the pyramidal (fig. C3 f.a.) also contributes to complete this expanded articular face, with a small portion that comes into play especially in the adduction movement.

To complete this proximal row, but with functions not related to the joint, via the pisiform bone (Fig. C4). It is a small sesamoid bone that articulates with the pyramidal overlapping this in the

palmar side; Its function is to allow insertion to the strong tendon of the flexor ulnar carpus muscle.

The bones of the distal carpal row basically constitute the deep concavity of the palmar surface of the carpus itself and are: the trapezoid (fig. C5), the trapezoid (fig. C6), the capitate (fig. C7) and the uncinat (fig. C5). . C8).

Together these form the so-called carpal shower (fig. C), a sort of concave depression that allows the passage of the tendons of the flexor muscles that originate from the skeleton of the forearm and enter the skeleton of the hand. This shower is enlarged in its concavity by the medial and lateral relief consisting of the hooked bones and the trapezoid, both placed at the ends of the distal row.

The hook is characterised by a protruding and curved process called hook (fig. Cu.), With which it creates a medial limitation of containment of the tendons and gives the transverse attachment of the carpus, a flat tendon tape, which stretches up to tubercle of the trapezoid, where it finds its insertion (fig. C t.), creates [the upper wall of the shower, transforming it into a real "channel" or "tunnel" carpic. In this way it isolates the deep path of the flexors from the more superficial layers of muscles that we will observe in the lessons dedicated to the hand muscles (see lesson 48, table II, fig. A detail).

The trapezium, characterised by a tubercle in relief, thus forms an unlimited lateral aspect of the carpal groove and is also equipped with a particular articular face (fig. C and particular fig. B fa) shaped like a saddle, with which it articulates with the first bone of the row of metacarpals. The latter is the metacarpal of the thumb which, thanks to this saddle-shaped joint mechanism, allows the thumb, in the flexion movement, to rotate towards the other fingers of the hand in order to allow grip, a fundamental characteristic of the functional capabilities of the hand.

Another functional aspect that characterises the bones of the proximal and distal carpal row is related to the flexion movement of the hand on the forearm, doe to the radio-carpal joint (fig. D). This movement not only involves the bones of the proximal row (fig. D1) but also those of the distal row (fig. D2) which, in turn,

articulate with the bones of the proximal row through a saddle joint, where the capita, largest bone in the distal row, with its articular head it connects to the concavity formed by the scaphoid and lunate (fig. C). Laterally, the scaphoid also articulates with the trapezoid and trapezoid. This joint, called midcarpal (fig. D), contributes precisely to making the flexion movement mechanically broader and more fluid, which in any case is controlled and supported by a large series of small ligaments.

Table I

Fig. A

Anterior or palmar view of the skeleton of the right hand: carpus, metacarpus, phalanges. Carpus bones:

1. scaphoid
2. semilunar
3. pyramidal
4. pisiforme
5. trapezium
6. trapezoid bone
7. hooked
8. hook

Fig. B

Palmar view of isolated carpal bones.

Detail fig. B.

Example of the saddle joint between the trapezoid and the first metacarpal.

Fig. C.

Volumetric view of the carpus in the joint relationships between the individual bones.

Proximal row bones:

1. scaphoid
2. semi lunar

- 3. pyramidal
- f. to. face joint for the radius
- 4. pisiform

Distal row bones:

- 5. trapezoid
- t. tubercle
- does. saddle joint face for the I metacarpal
- 6. trapezoid
- 7. happened
- t.a. articular head of the capita to for the scaphoid and lunate
- 8. hooked
- u. hook

Fig D.

Radio-carpal and mid-carpal joint seen in the longitudinal section of the carpus: example of dorsal flexion and palmar flexion movement.

r. radio

- 1. bones of the proximal carpal row: the lunate
- 2. bones of the distal carpal row: the capita

Fig. E

Proportional ratios of the hand. The overall height of the hand is equivalent to the modular proportional ratio corresponding to the face F, while the width of the palm is equivalent to the modular ratio of $\frac{1}{3}$ of the module of the T head.

Fig. F

Pronation of the hand and dorsiflexion of the palm.

Lesson 37

THE METACARPUS AND JOINTS OF THE HAND

II metacarpus (plate I, fig. A)

It is made up of five long bones. Each of these is given by a body or diaphysis and by two extremities or epiphyses.

The body or shaft (fig. A d.) Reveals in the section a prismatic shape, with a slightly curved longitudinal direction, which is concave on the palmar side.

The proximal extremity has a base (fig. A b.) Which joins in the wedge-shaped joint with the row of the distal carpal bones. The distal end is completed in a hemispherical head (fig. At.) Slightly dilated on the transverse axis. This shape is well suited in the joint conjunction with the first phalanges (see particular fig. D t.), Making them particularly mobile.

It should be noted that the second metacarpus is the longest one, followed in decreasing order by the third, fourth and fifth metacarpus and the shortest is the largest; not being aligned with the others, and more advanced anteriorly. In the proximal extremity, the first metacarpus has a peculiarity: the saddle joint which, as we have already seen, is equipped with an articular face different from all the others and which is modelled on the corresponding trapezium. This joint makes the first metacarpus particularly mobile, which is thus able to transmit that movement called opposition to the thumb. All the heads of the metacarpus protrude on the dorsal margin (see fig. B), when the hand closes on its fingers.

Table I

Fig. A

Postero-dorsal view of the skeleton of the hand and lateral and medial view.

I-V mt. metacarpal bones

- b. base
- d. diaphysis
- t articular head
- 1. carpometacarpal joints
- 2. intermetacarpal joints

Detail Fig. A

The metacarpal bones isolated.

- 1. joint faces for the bones of the distal carpal row:
carpometacarpal joints)
approx. happened
- s. semilunar
- II mt. II metacarpal
- 2 joint faces for the III metacarpal: intermetacarpal joints)

Fig. B

Forearm pronation and supination movements with hand flexion.

Fig. C.

Movement of the carpus on the
radius: radiocarpal joint.

- 1. movement of radial abduction
- 2. ulnar adduction movement
- p.s. styloid process of the radius

Fig D.

Movement of the carpus on the radius: radiocarpal joint.

- 1. dorsiflexion
- 2. extension
- 3. palmar flexion

Detail D

Metacarpophalangeal joints: flexion of the first phalanges on the
heads of the metacarpus and interphalangeal joints
successive between the second phalanx and the third.
Exploded view in sagittal section of the midcarpal joint

Joints of the hand

There are several articular devices that determine the movements of the skeleton of the hand. We observe these joints only from the mechanical point of view, without analysing that vast series of ligaments which, like a dense texture, intimately unite them but which do not decisively influence the thicknesses and volumetric contents of the shape we are dealing with.

Wrist joint, radio-carpal and mid-carpal

The radiocarpal joint is related to the connection of the carpus to the radius. The carpus, with its broad articular surface of convex and ellipsoidal shape due to the bones of the scaphoid, semilunar and pyramidal, runs on the concave articular face of the radius. This joint produces three types of movement:

- a movement according to the margin (fig. C) which occurs on the transverse radio-ulnar axis and determines the radial abduction (fig. C1) and the ulnar abduction of the hand with respect to the forearm (fig. C2). It should be noted that the second movement is larger than the first and is limited by the styloid process of the radius (fig. C p.s.);
- a movement according to the faces (fig. D), which involves dorsal flexion (fig. D1) and palmar flexion of the hand (fig. D3); it is in this flexion movement that the midcarpal joint intervenes (detail fig. D) which, as we saw in the previous lesson, widens and makes the movement graduate;
- a circling movement of the hand that is the result of a combined succession of palmar flexion movements: adduction, dorsiflexion and abduction.

The joints between the carpus and metacarpal bones

The carpometacarpal joints (fig. A1 and detail A) belong to the amphiarthrosis group and take place between the distal row of the carpus and the proximal row of the metacarpus. There is limited movement from the proximal exterior of the 2nd metacarpus to the 5th metacarpus. The first metacarpus is an exception in this joint, with its saddle joint, which, as we have already observed,

it allows the abduction and adduction of the thumb and its opposition on the other fingers.

The joints between the metacarpal bones of the intermetacarpal (fig. A2 and detail A) are also amphiarthrosis. They have their seat in the proximal end of the metacarpus Ira the proper faces of the II, III, IV and V metacarpus. These joints allow a linear movement along the longitudinal axis of the respective bones.

Lesson 38

THE PHALANGES OF THE HAND AND THEIR JOINTS

The phalanges (plate 1) are the mobile segments of the fingers, three in number from the second to the fifth finger and two for the thumb. They are divided into proximal phalanx or I phalanx, middle phalanx or II phalanx and distal phalanx or III phalanx. Like all long bones, they too have one shaft and two extremities or epiphyses.

I phalanx

It exposes to the proximal extremity: a base turned to the head of the metacarpus with a slightly concave articular face; a more thinned body or shaft with a slight dorsal convexity; a distal end with an articular trochlea shape which reproduces in miniature the shape of the two truncated cones, which determine the medial sulcus corresponding to the joint for the second phalanx.

II phalanx

Shorter than the first phalanx, it has on the proximal extremity an articular face coinciding with the trochlea of the first phalanx and is equipped with a small medial crest that adapts to the sulcus of the same trochlea. The distal end is identical to that of the first phalanx, but smaller.

III phalanx

Even shorter than the previous ones, it has a slightly smaller proximal draft, coinciding with the trochlea of the second phalanx; the distal end is completed with a dilated tuberos apex with a smooth surface on the dorsal side and wrinkled on the palmar side. These correspond respectively to the formation of the nail and the fingertip. The phalanges of the thumb have only a more voluminous and shorter form, but the same articular device.

Joints between metacarpus and phalanges called metacarpophalanges (figs. A-C).

They are joints that occur between the heads of the metacarpus and the base of the first phalanges. They have a spherical shape, and allow the fingers to slide both antero-posteriorly, for example

when closing the hand, and sideways, when the fingers move away from each other.

Joints between individual phalanges or interphalangeal joints (figs. A-B).

They are angular ginglymo. The trochlea shape of the articular face determines only flexion and extension movements.

Table I

Fig. A

Studies on the various types of joints and on the renewal of the skeleton of the hand.

Fig. B

Study on the articular trochlea devices that determine the angular ginglymo movement in the phalanges.

Fig. C.

Profile view of the joint between metacarpus and phalanges and between phalanges I and II.

1. metacarpal phalangeal joint
2. interphalangeal joint

Fig D.

The essential volume of the right mana seen from the palmar, dorsal and lateral profile.

- c. carpus. Its semicircular shape is more dilated in the transverse direction; we note the concavity of the palmar side and the convexity of the dorsal side
- mt. metacarpus; shape also characterized by a palmar concavity and dorsal convexity, with the rounded distal end that follows the profile of the metacarpal heads.
- f. phalanges

Fig. E

Relation between skeleton and perimeter in the right mano seen from the palmar and dorsal sides.

- p. Pollex (Thumb)
 - i. index (Pointer)
 - m. Middle
 - a. annular
 - mi. little finger
-

Lesson 39

THE MUSCLES OF THE TRUNK (TORSO)

The various muscle bands of the trunk that cover the skeleton, in an extension that goes from the head, the cervical part of the vertebral column, and from the scapular girdle to the thoracic cage and lumbar spine up to the skeleton of the pelvis, can be divided into three main categories related to their functional activity: the muscles of the abdomen, thorax and back.

THE MUSCLES OF THE ABDOMEN

They form the anterior and lateral walls of the abdominal region corresponding to the area that goes from the lower edge of the thorax to the iliac crests and inguinal ligament. They form a muscular belt that contains the abdominal viscera and which determines the forward flexion, sideways and rotation movement of the trunk, a movement that is transmitted to the rib cage, where the muscles of the abdomen have insertion and, consequently, to the stretch lumbar vertebral; this movement will be opposed by so-called antagonist muscles: the erectors of the spinal column (see lesson 41).

The muscles of the abdomen, from the outside to the inside and from the lateral area to the medial area, are: external oblique (1), internal oblique (2a), transverse (2b), rectus abdominis (3), pyramidal (4).

External oblique of the abdomen (Tav. It)

It is the most superficial of the abdominal muscles and is located in the lateral anterior walls. Wide and thin, it has oblique muscle fibres which, starting from the ribs (fig. A1), go anteriorly downwards, transforming, just before the rectus abdominis (fig. A3), into an aponeurosis, a robust tendon lamina which covers the anterior rectum (fig. C1).

The fibres of this vast abdominal aponeurosis (figs. A-C a.a.) cross with the tendon fibres of the other external oblique and together

form, in the superficial layer, the linea alba (figs. C-D l.a.), A long and thin, taut fibrous ribbon. from the xiphoid process to the pubic symphysis.

The aponeurosis (fig. A a.), Which also extends towards the ileum-pubic branch by inserting the inguinal attachment (fig. A li), contributes to forming the thickness of the inguinal arch which differentiates the area of the abdomen from that of the leg.

Origin (fig. A1): from the lateral face of the ribs starting from V to XII with eight digitations that intersect with that of the anterior serratus (fig. B6) and the great dorsal (fig. B1 and see also lesson 40, pl. . I, fig. C).

Insertion: the lateral fibres are brought to the external margin of the iliac crest (figs. A-B c.i.); the others proceed in the medial and inferior direction in the abdominal aponeurosis and downwards above the inguinal attachment (see also lesson 40).

Function: the external obliques flex the chest over the pelvis and vice versa; they lower the agenda ribs like exhalation muscles. If only one oblique is contracted, we have the lateral inclination of the trunk on the pelvis (table I, figs. F-G 1). In the contraction we can distinguish a vertical depression between muscle and tendon which begins near the last ribs and continues up to the anterior and superior iliac spine of the pelvis.

Internal oblique of the abdomen (pl. I, 2a)

It is entirely covered by the external oblique. It, too, is broad and thin, with ascending fibres that radiate from the iliac crest in a fan shape from the bottom to the top and forward, on the last ribs and on the abdominal sheath.

The slightly transversal section above the navel (table I, fig. C 2a) it reveals its intermediate position with respect to the external and transverse oblique; it can be seen that from its anterior margin the muscle branches into two tendon aponeuroses, two fibrous "sheets", one anterior and one posterior, which contribute to the

formation of the abdominal sheath that covers the rectus muscle of the abdomen anteriorly and posteriorly, thus offering a said to insertion to this double anterior muscle pillar. The two sheets intersect on the median, contributing to the formation of the linea alba (fig. C I. a.), Then welcoming in the anterior and posterior surface the tendinous amines of the external oblique and the transverse.

Function: it cooperates in synergy with the external oblique, but it can become its antagonist causing the torsion of the trunk (see fig. E).

Transverse abdominis (table I, 2b)

Located behind the internal oblique, it is the deepest (fig. C 2b). Very flattened throughout its surface, it has fibres arranged horizontally and contributes to the formation of the posterior wall of the abdominal sheath.

Rectus abdominis (Table I, 3)

Arranged along the longitudinal direction of the abdomen, it includes the whole area from the anterior costal arch to the pubis. It is similar to a flattened ribbon with a slightly convex front, longer at the top. The linea alba pasta on the median separates the rectum into two muscular bellies. Its surface, despite being covered by the abdominal aponeurosis of the obliques, shows a series of narrow transverse depressions called tendon inscriptions (fig. D i.t.). There are usually three, located one at the navel level and two above it.

Origin: from the costal cartilages of the V, VI and VII ribs (fig. De see also lesson 40, pl. I, figs. B-C).

Insertion: in the two tubercles and in the superior margin of the pubis, between these (fig. D and see also lesson 40).

Function: and main flexor of the trunk on the pelvis and vice versa (fig. G3).

Pyramidal (plate I, 4)

It is a small, triangular-shaped muscle that lines the lower end of the rectus abdominis.

Origin: in front of the insertion of the rectus abdominis (fig. D4).
Insertion: with its apex on the linea alba (fig. D4).
Function: tends to the dawn line, determining the lower depression of the latter.

Table I

Fig. A

Anterior frontal view of the superficial muscles of the abdomen and of the chest muscles.

1. external oblique (origin and trajectory)
 - a.a. abdominal aponeurosis and tendon sheath that lines the rectus muscle
 - c.i. iliac crest
 - a. inguinal tract aponeurosis
 - l.i. inguinal connection
3. rectus abdominis (costal origin)
4. pyramidal
- int. ti. internal interchastals
- int. is. external interchastals

Fig. B

Lateral view of the plastic relief of the muscilar apparatus of the trunk.

1. muscilar digitations of the external oblique
6. muscilar digitations of the anterior dentate
5. large breastplate:
 - a. partial clavicle
 - b. sterna-castale partial
 - c. abdominal partial
- 9a. partial clavicular, acromial and spine of the scapula of the trapezius muscle

Fig. C

Transverse section of the trunk, placed above the navel.

1. external oblique
- 2a. internal oblique
- 2b. transverse
- a.a. abdominal aponeurosis
- l.a. linea alba
3. rectus abdominis

Fig D.

Anterior frontal view of the trunk muscles.

- i.t. tendon inscriptions
3. rectus abdominis
5. large breastplate:
 - a. clavicular portion
 - b. sterno-costal portion
 - c. abdominal portion
6. dentate-muscular digitations
- 9a. clavicular portion of the trapezoid
10. insertion of the great dorsal muscle: in the medial lip of the bicipital groove
- t.u. tubercle of the pubis

Fig. E

Twisting movement.

- 2a. internal oblique
1. external oblique

Fig. F

Lateral inclination movement of the trunk.

1. external oblique

Fig. G.

Abdominal flexion movement.

3. rectus abdominis
 1. external oblique
-

Lesson 40

THE MUSCLES OF THE THORAX AND THE THORACO-APPENDICULAR MUSCLES

THE MUSCLES OF THE TORACE

The structure of the rib cage is completed by a series of muscles, the intercostals, which occupy the empty spaces between one rib and the other. They have the function of raising or lowering the ribs during breathing and are made up of three thin overlapping muscle layers, called external, internal and intimate intercostals. Given their location, they are not visible from the outside (see table I lesson 39 fig. A), so we limit ourselves to enunciating them without going into details.

THE THORACO-APPENDICULAR MUSCLES

We will now deal with the muscles that are related both to the skeleton of the thorax and to that of the upper limb, that is to say with the scapular girdle and the humerus, called thoraco-appendicular, the only ones of this anatomical area to be evident in the plastic morphology. They are divided into: pectoralis major (5), pectoralis minor, subclavian, anterior serratus (6).

Large breastplate (plate I 5)

It is a very developed and extended muscle and triangular in shape. It covers the anterior and upper walls of the thorax from the sternum to the collarbone and inserts into the upper end of the humerus. Although visualised in a single form, three main portions can be distinguished, a sternocostal, a clavicular and an abdominal one, which take on different roles during the various movements (for example, in the movement of the arm forward and medially the active nucleus and supported by the clavicular portion, while the vast sternocostal portion remains inactive).

The sternoclavicular portion (fig. A 5b) is the widest and is in turn interspersed with different muscle portions.

The clavicular portion (fig. A 5a), less extended, is ribbon-like and

oriented in an oblique direction.

The abdominal portion (fig. A 5c) is the smallest and therefore the most negligible.

It should be noted how the bundles of these portions converge laterally crossing and overlapping each other just before their insertion on the humerus.

Origin: the clavicular portion (fig. C 5a) rises from the sternal end of the clavicle; the sternocostal portion (fig. C 5b) is formed from the medial sternal line and from the area of the cartilages thus from the 2nd to the 6th rib, the abdominal portion (fig. C 5c) originates from the tendon lamina and aponeurosis that covers the abdominal area.

Insertion: coincides in a short distance with the lateral margin of the bicipital groove of the humerus (fig. C d.b.). Before reaching the humerus, the clavicular portion, narrowing, moves downwards overlapping the sternocostal one, arranged horizontally. The abdominal portion, moving upwards, crosses the sternocostal bundles passing under them. The terminal section is thus, as a whole, twisted on itself (fig. C). Near its insertion, the pectoralis major forms that anterior wall or pillar that delimits the axillary cavity (pl. I, fig. E, and see pl. II, fig. C-D).

Function: as a whole, the pectoralis major adds to the arm. The clavicular fascia also manages to bring the humerus forward and medially, thus allowing the arms to meet anteriorly (Plate II, Fig. A). Furthermore, when the arms are raised and fixed, it can bring the trunk closer, bringing it forward and upwards, as for example in the climbing phases.

Table I

Fig. A

Frontal view of the plastic relief of the muscular apparatus of the thorax and abdomen.

Fig. B

Lateral view: origin, insertion and trajectories of the muscles of the thorax and abdomen (the scapula is moved away from its natural

position to better identify the origin of the anterior serratus muscle).

- 6. serratus anterior:
 - a. upper portion
 - b. intermediate portion
 - c. lower portion
- 1. external oblique of the abdomen
- 3. rectus abdominis
- 10. great dorsal

Fig. C.

Frontal view: origin, insertion and trajectories of the muscles of the thorax and abdomen.

- 5. large breastplate:
 - a. clavicular portion
 - b. sternocostal portion
 - c. abdominal portion
- d.b. bicipital shower
- 6.a.b.c. toothed anterior

Fig D.

Lateral view of the muscles of the trunk and ad dome.

- 6.a.b.c. serratus anterior
- 1. external oblique of the abdomen
- 3. rectus abdominis

Fig. E

Lateral view of the plastic relief of the muscles of the thorax and abdomen: in evidence the two muscular pillars that delimit the axillary cavity.

- p.a. anterior pillar
- S.a.b.c. large pectoral
- p.p. posterior pillar
- 10. great dorsal
- 6. digitations of the anterior dentate muscle visible between the two anterior and posterior muscle pillars
- 1. digitations of the external oblique muscle of the

abdomen.

Small pectoral and subclavian

Both the pectoralis minor, thin and triangular, which is located below the pectoralis major, and the subclavian, which lies between the clavicle and the first rib, are excluded from the analysis as they are completely hidden.

Anterior toothed (plate I 6)

Extended and flattened, it covers the lateral and posterior walls of the thorax. A considerable part of its surface is covered by the shoulder blade and superimposed muscles. What is evident on observation is a series of four or five digitations interposed between the great dorsal, the pectoral major and the external oblique of the abdomen, which manifest themselves on the skin in the contraction of the muscle and which can be seen in greater number. under the axillary cavity when the arm is raised (fig. E6).

Original: from the lateral face of the first eight or nine ribs by means of a corresponding number of digits (fig. B6).

Insertion: the digitations, moving towards the scapula, unify into three muscular parts which, passing between the lateral-posterior wall of the thorax and the subscapularis muscle, connect to the margin of the scapula (fig. B6): respectively, the upper part (figs. BD 6a), near the upper corner of the scapula, the intermediate part (figs. B-D6b), along the entire medial margin of the scapula, and the lower part (figs. BD 6c), in correspondence with the angola lower shoulder blade.

Function: all parts of the serratus anterior bring the scapula forward. The lower part moves the lower angle of the scapula outward and forward, thus contributing to the elevation of the arm (plate II, figs. C-D). All three parts can raise the ribs when the scapula becomes fixed point.

TAV. II

Figs. A-B-C-D

The pectoralis major muscle in the abduction movement of the

arm.

Anterior pillar of the armpit:

- 5 large bib:
 - a. sternal portion
 - b. sternocostal portion
 - c. abdominal portion

Posterior pillar of the axillary cavity:

- 10. great dorsal
- g.r. large rotunda: belongs
to the shoulder musculature

Arm muscles:

- d. deltoid
 - b. biceps
 - c.b. coracobrachialis
 - t. triceps
-

Lesson 41

THE MUSCLES OF THE BACK

It is a set of large muscle bundles that covers the posterior wall of the trunk and can be divided mainly into two categories, the deep, medium and superficial muscles.

THE DEEP AND MIDDLE MUSCLES OF THE BACK

The deep and middle muscles belong to the proper muscles of the thorax and the vertebral column and are respectively called sacrospinal or erector of the vertebral column, and spinocostal; these, extending from the sacrum to the occipital of the head and relating to the vertebrae and the ribs, act on the movement of the trunk, contributing to body support. The superficial muscles, better referred to as spinomeral, also originate from the dorsum but act on the movement of the shoulder and arm, having insertion into the backbone and shoulder girdle. Consequently, they can also be considered to belong to the category of upper limb muscles. In this lesson we will deal with the more superficial ones, while we will deal with the deep and medium only in how many plastic volumes that are at the base of the morphological relief of the plastic form of the trunk.

The deep sacrospinal or erector muscles of the vertebral column have the fundamental function of erecting the vertebral column and the head on the hips; as many erectors, they are like ropes stretched in a reciprocal relationship of origin and insertion between the sacra, the lumbar vertebrae, the rib cage and the head. This muscular part as a whole is thus formed by two sturdy mobile pillars placed on the sides of the spinous processes of the vertebrae, a set of muscles which, although not visible, invest the dorsal surface with their plastic relief, especially in the thoracolumbar region. occupying in the posterior region of the thoracic cage the space called pulmonary shower (delimited by the spinous processes of the vertebrae up to the costal angola). In the lumbar region these pillars expand laterally starting from the spinous

processes in two convex and longitudinal reliefs. These above connect to inferior posterior margin of the rib cage and they are brought down until sacra and to the first posterior portion of the iliac crest (see lesson 39, plate I, fig. C), forming the covered lumbar relief highlighted by the most superficial muscle, the great dorsal, which adheres to it like a sheath.

The middle or spinocostal muscles are formed by the superior posterior dentate and the inferior posterior dentate which, being entirely hidden and thin, do not influence the external morphology of the dorsum. Hanna la function of containing the passage of deep muscles along the pulmonary sulcus, as well as raising and lowering the ribs from the posterior side.

THE SUPERFICIAL MUSCLES OF THE BACK

The superficial or spinomeral muscles cover the entire dorsal surface of the trunk except the infraspinatus space of the scapula. Originating along the medial axis of the vertebral column, from the extremities of the occipital and pelvis, the muscles extend laterally on the shoulder girdle and on the upper extremity of the arm. In general they have the function of determining the movements of the shoulders, the head and the upper limb.

They are divided into: scapula levator (7), rhomboid muscles (8), trapezoid (9), great dorsal (10).

Shoulder lifter (Table I figs. B-C 7)

Corresponds to the back and side of the glue. It is elongated and flattened, placed obliquely between the cervical vertebrae and the upper margin of the scapula. It is largely hidden by the trapezoid, but is visible for a short distance in a lateral interstitium of the glue bounded by the sternocleidomastoid, the splenia of the head, and the trapezoid.

Origin (fig. B7): from the four transverse processes of the first four cervical vertebrae. It is initially divided into four tendons, which then spread into the single muscular body.

Insertion: in the medial margin of the scapula, near the superior angula.

Function: raises the scapula and leads to the cervical vertebrae.

Table I

Fig. A

Posterior front view of the plastic relief of the muscular system of the back.

Fig. B

Muscle origin and insertion and trajectories of the back muscles.

- 7. scapula elevator
- 8a. large rhomboid
- 8b. small rhomboid
- 9. trapezoid:
 - a. upper portion
 - b. medium portion
 - c. lower portion
- 10. great dorsal

Fig. C

Posterior frontal view of the spinal muscles.

- 7. scapula elevator
- 8a. large rhomboid
- 8b. small rhomboid

Fig D.

Shoulder elevation movement.

- 9a. upper portion of the trapezia muscle

Fig. E

Posterior rotation movement of the scapula and adduction movement of the humerus.

- 9b. middle portion of the trapezius muscle
- 10. great dorsal

Fig.F

Scapula elevation movement with abduction of the humerus and mechanical behaviour of the upper and lower muscle bundles of the trapezoid.

9a. upper portion

9c. lower portion

Fig. G.

Postero-lateral view of the back muscles seen in the plastic relief.

Rhomboids (pl. I, figs. B-C-8a-8b)

They are divided into a large rhomboid (fig. 8a) and a small rhomboid (fig. 8b). They are ribbon-like muscles placed under the trapezius between the shoulder blades and the vertebrate column. Directed obliquely, they can be seen in the small area bounded by the scapula, the trapezius and the great dorsal (see figs. A-G). Although they are largely hidden by the trapezium, they show their plastic relief especially when they contract.

Origin: the great rhomboid originates (fig. B 8a) from the first four spinous processes of the thoracic vertebrae. The small rhomboid originates (fig. B 8b) from the last two spinous processes of the cervical vertebrae.

Insertion: the large rhomboid in the lower part of the medial margin of the scapula, the small in the short upper part.

Function: in addition to fixing the scapula on the posterior wall of the rib cage, they lead upward and medially.

Trapezoid (plate I, figs. A-B 9)

It is extended and thin, triangular in shape and covers the entire upper, posterior and lateral region of the shoulders, as well as the posterior medial part of the neck and back, and can be divided into three muscular portions: an upper one (fig. 9a), an average (fig. 9b) and a lower (fig. 9c), which have different functions. It should be

noted that near the spinous processes of the vertebrae the muscle flattens into a tendon lamina, more extended between the last cervical and the first thoracic ones. The result is a depression which accentuates even more the muscular portions in the plastic relief.

Origin (figs. A-B 9): it arises from the protuberance of the occipital, from the superior nuchal line, from the spinous processes, from the VII cervical vertebra to all the thoracic vertebrae.

Insertion: the upper portion (fig. B 9a) of the occipital is directed obliquely with its fibres downwards and outwards, on the clavicle and the scapula; The middle portion (fig. B 9b) from the VII cervical and the first thoracic vertebrae is placed on the spine of the scapula; The lower portion (Fig. B 9C) from the spinous processes of the lower thoracic vertebrae goes obliquely towards the top and the outside on the medial apex of the scapula.

Function: as a whole, the trapezius raises the head on the shoulders; The upper portion raises the shoulders and with a fixed point on them brings the head back, extending the neck (fig. D 9a); The middle portion brings the shoulder blades closer to the midline, bringing the shoulders back (fig. E 9b); The lower portion leads the scapula down and medially (fig. F 9C).

The upper and lower portions interact to determine the elevation of the shoulder; in fact, the upper portion raises the scapular girdle while, from the opposite side, the lower portion moves the scapula down. In this way a double movement towards the inside and the outside of the scapula is obtained, the spine of which in an oblique direction approaches the vertical of the vertebral column (fig. F).

Great dorsal (plate II, figs. A-B10)

Very extended and laminiform, it includes the lumbo-dorsal and axillary area. It has a large thin tendon lamina that spreads throughout the lumbar area and a muscle portion that begins to manifest itself in the lower rib arch. Like an enveloping cloak, it covers the lower and posterior area of the thorax, covers the lower extremity of the scapula and goes to the upper extremity of the humerus, adhering in this last stretch to the large rotunda muscle of the shoulder.

Origin (plate II, fig. A; see also plate I, fig. B): from the last six or seven thoracic vertebrae (spinous processes), from all lumbar and sacral vertebrae (la to dorsal), from the posterior third of the iliac crest and the last four ribs. At the level of the thoracic vertebrae it remains hidden by the trapezoid (plate II, fig. A).

Insertion: in the medial crest of the bicipital sulcus, anterior side of the humerus. Moving towards the humerus, the great dorsal gradually narrows, making an enveloping twist on the large rotunda (figs. B-C). In this last section it brings the upper edge down and the lower edge up (figs. B-C-D-detail C- m.i., m.s.). Together with the large rotunda of the shoulder (fig. E g.r.), it forms the mobile wall or posterior pillar that delimits the axillary cavity (fig. E).

Function: when the arm is raised, the great dorsal lowers the shoulder and can bring the arm down (fig. D10), backwards and medially (see table 1, fig. E 10).

Fig. A
Posterior frontal view of the plastic relief of the superficial muscles of the back.

- 9. trapezoid
- 10. great dorsal

Figs. B-C
Lateral view of the trunk muscles.

- 10. great dorsal
- m.s. top margin
- m.i. bottom margin

Detail fig. C.
Twisting course of the great dorsal muscle on the large rotunda muscle.

- 10. great dorsal

g.r. large roundabout
d.b. bicipital shower
m.m. medial margin of the bicipital shower
m.s. top margin
m.i. bottom margin

Figs. D-E

Behaviour of the great dorsal muscle in the various abduction and adduction movements of the arm.

Lesson 42

THE ANTERIOR AND LATERAL MUSCLES OF THE NECK

The neck muscles belong to the region of the human body that runs from the lower end of the head. It is defined by the skeletal perimeter that starts from the inner face of the mandible and proceeds to the mastoid apophysis of the temporal bones. From here they are connected to the upper extremity of the skeleton of the trunk in the sternum, in the clavicle and in the upper face of the first two ribs; moreover, they will find connection in the intermediate skeletal parts, consisting of the cervical vertebrae and the apparatus of the larynx, formed in turn by the hyoid bone and the underlying cartilages, thus defining the anterolateral and posterior muscular perimeter of the neck region.

This set of short muscle bundles can therefore be divided into three areas: the anterior, lateral and posterior muscles. We will analyse the anterior and lateral muscles here, since the posterior muscles have already been practically analysed in the lesson on the back muscles (see lesson 41).

THE ANTERIOR MUSCLES

The anterior muscles are divided into three categories: suprajoide muscles, subjoide muscles (table I, figs. A-B) and prevertebral muscles. We will discuss in detail only the first two from the moment that the prevertebrals occupy a deep layer, and therefore not visible, with the function of connecting the cervical vertebrae from the ventral side to the occipital of the head; they are long of the neck, long of the head, anterior rectus of the head and lateral rectus of the head, and operate as flexors of the head and neck.

Before going into the analysis of the suprajoide and subjoide muscles, let us pause to describe the apparatus of the larynx (table I, figs. C-D). This consists of the joide bone (fig. C j.), The thyroid cartilage (fig. C c.t.) and the cricoid cartilage (fig. C c.c.) which in turn connects to the trachea (fig. C tr.). This osteocartilage construction constitutes a sort of envelope for the larynx and on

the outside offers insertion and origin to those muscles that come from the lower end and continue on the upper end of the glue. It can also be detected at the epidermal level in the protrusion, called thyroid notch (figs. C-E-F i.t.), of the thyroid cartilage commonly called "Adam's apple", noticeable and more visible in swallowing.

The joide (hyoid) bone is a small bone suspended in the anterior region of the neck (see fig. B j.), Placed between the 4th and 5th cervical vertebrae. U-shaped, and connected to the styloid processes of the temporal bones by the subtle stylojoide muscles. As is evident from the figures, and in particular from the exploded views, the bones are made up of a body (fig. A. c.), Two large comas (fig. A g.c.) and two small ones (fig. A p.c.).

The body is arranged on the transverse direction with a slight anterior convexity; at its ends the small comas branch anteriorly and laterally and the large comas more posteriorly.

The thyroid cartilage (fig. C c.t.) is linked to the lower edge of the joide by a fibrous membrane and has a body shaped on two! Amines that converge medially and diverge posteriorly and sideways. On the anterior and superior margin along the median we note the thyroid notch corresponding to the tip of greater anterior protrusion (fig. C i.t.). On the posterior margins there are four appendages called upper and lower comas which are connected at the top, with the special ligaments, to the large coma of the joide bones and at the bottom to the cricoid cartilage.

The cricoid cartilage (fig. C c.c.) is located immediately under the thyroid cartilage, joined to it by its own components and has a ring shape, narrower on the anterior side. On its entire lower annular margin it is linked to the tracheal duct (fig. C tr.).

THE SUPERJOID MUSCLES

They are located in the space that goes from the joide bones to the mandible and together constitute a sort of oblique "floor" for the mandible. They are divided into digastric (1), stylojoideo (2), milojoideo (3), genojoideo.

Digastric (figs. A-B-D 1)

Located under the mandible, it has two fusiform muscular bellies, one posterior (figs. A-B 1a) and one anterior (figs. A-B 1b), joined by an intermediate cylindrical tendon. The muscle is placed under tension by a small fibrous ribbon which, enveloping the intermediate tendon, joins the beginning of the great horn of the joide. The two bellies are arranged at an obtuse angle towards the mandible.

Origin: the posterior abdomen (figs. A-B 1a), the longest, rises from the mastoid notch of the temporal and, moving forward and downwards, tapers into the intermediate tendon.

Insertion: the anterior abdomen (figs. A-B 1b) joins the internal face of the body of the mandible near the median in the digastric dimple. Moving posteriorly and downwards, it too tapers into the intermediate tendon.

Function: contracting at the same time, the two muscular bellies raise the joid bones together with the larynx. The reverse movement can lower the jaw.

Stilojoideo (figs. A-B-D 2)

Very thin and long, and located laterally in front of the posterior belly of the digastric muscle. On the distal end it presents a bifurcation within which the intermediate digastric tendon passes.

Origin: styloid process of the temporal.

Insertion: in front of the little horn of the joide.

Function: Brings the joide bones back and up.

Milojoideo (figs. A-B-D 3)

Located above the anterior belly of the digastric, it is flat, thin and triangular in shape, arranged bilaterally on the deep and lower area of the mandible. The muscles in both sides are joined in the midline by a fibrous raphe stretched from the chin to the joide bone.

Origin: milojoid line on the internal area of the mandible.

Insertion: upper margin of the body of the joide.

Function: raises the joide bones and lowers the jaw. In swallowing you can see its contraction.

Genojoideo

It is connected to the intrinsic muscles of the tongue and being deep and covered by the milojoideo will not be treated.

Table I

Fig. A

Anterior view of the neck muscles with the joid bone slightly lowered to highlight the suprajoide muscles.

- j. joide bones
- c. body
- p.c. small coma
- g.c. large comas

Soprajoidei

- 1 digastric:
 - a. posterior belly
 - b. anterior belly
- 2. stilojoideo
- 3. milojoideo

Subjoidei

- 4. stemojoideo
- 5 omojoideo:
 - a. upper belly
 - b. lower belly
- 6. stemothyroid
- 7. thyroid
- 8. sternocleidomastoid

Fig. B

Lateral view of the glue muscles.

- 8. sternocleidomastoid (and indicated as a trajectory to better observe the scalene muscles and the sternojoide)
- 9. anterior scalenus

- 10. middle scalene
- 11. Posterior scalenus

Fig. C.

Anterolateral view of the osteocartilage complex of the larynx.

- j. joide bones
- c.t. thyroid cartilage
- i.t. thyroid notch
- c.c. cricoid cartilage
- tr. trachea
- 6. line of insertion of the sternothyroid muscle
- 7. line of origin of the thyroid muscle

Fig D.

Connections of the suprajoide and subjoide muscles to the larynx.

Fig. E

Anterolateral view of the plastic relief of the neck muscles.

- j. bone joide
- i.t. thyroid notch
- 4. sternojoideo
- 8. sternocleidornastoid
- 9 anterior scalene
- 10 medium scalene
- 11 posterior scalene
- t. trapezoid

Fig.F

Plastic relief showing the structure of the larynx.

THE SUBJOID MUSCLES

They are located in the space from the joide bone to the sternum and collarbone. They pass in front of the larynx, the thyroid gland and the trachea. They are also antagonists of the suprajoide muscles in bringing down the structure of the larynx. They are divided into sternojoideo (4), omojoideo (5), sternothyroid (6),

thyroid (7).

Sternojoideo (figs. A-B-D-E 4)

It is a tight, flattened ribbon muscle.

Origin: from the inner face of the manubria of the sternum and from the sternoclavicular joint.

Insertion: on the lower edge of the body of the joide.

Function: lowers the joint bone together with the larynx.

Omojoideo (figs. A-Ds)

It is thin and long, formed by two muscular bellies, an upper one (fig. A 5a) and a lower one (fig. A 5b), joined by an intermediate tendon. The muscle is held in angular tension by a band that wraps around the intermediate tendon and which in turn is placed behind the collarbone and the rib. Although it is placed on a deep plane, it can emerge in the epidermal relief during the prolonged and violent efforts of inspiration.

Origin: the lower abdomen (fig. A 5b) from the upper edge of the scapula near the supracoracoid notch. Moving medially forward and a little high, it crosses the lower part of the neck.

Insertion: the upper abdomen (figs. A-D 5a), moving upwards, is inserted on the lower edge of the joide, laterally with respect to the insertion of the sternojoide.

Function: lowers the joide bone.

Sternothyroid (figs. A-D 6)

Nastriforme and shorter than the stemojoideo, it is found under it and largely hidden.

Origin: slightly below the stemojoideo, on the inlema face of the manubria of the sternum and of the 1st costal cartilage.

Insertion: on the external face of the thyroid cartilage, in a short oblique line (figs. C-D 6).

Function: lowers the larynx.

Tirojoideo (figs. A-D 7)

Sternothyroid (figs. A-D 6)

Nastriforme and shorter than the sternojoideo, it is found under it and largely hidden.

Origin: slightly below the sternojoideo, on the inner face of the manubria of the sternum and of the 1st rib cartilage

Insertion: on the external face of the thyroid cartilage, in a short oblique line (figs. C-D 6).

Function: lowers the joide bone and, vice versa, can raise the larynx.

THE LATERAL MUSCLES

Lateral muscles of the glue are the sternocleidomastoid (8), the platysma, the anterior scalene (9), the medial scalene (10), the posterior scalene (11).

Sternocleidomastoid (Table I, Figs. B-C-D 8)

It is the most striking muscle of the glue, due to its surface level and its developed shape. Like a large stretched rope, it obliquely crosses the entire length of the glue. With a thinner and flattened sternoclavicular beginning it continues dilating in the central body, until it reaches the head behind the pavilion of the ear. As the name indicates, the muscle has three heads: sternal (figs. B-C 8a), clavicular (figs. B-C 8b) and mastoid (figs. B-D 8c). The sternal head, converging on the manubria of the sternum, accentuates the depression of the suprasternal dimple at the epidermal level (figs. C-G f.s.), while the mastoid head highlights its epidermal presence in the lateral rotation movements of the head.

Original: with the sternal head (fig. B-C 8a), thin and cylindrical, on the front face of the sternum manubria; with the clavicular head (fig. B-C 8b), flattened and ribbon-like, on the upper edge of the sternal extremity of the clavicle. The two ends, originally distinct, blend together as they rise to form the plastic body of the muscle.

Insertion: with the mastoid head (fig. B-D 8c) in the mastoid process of the temporal and partly in the superior nuchal line of the occipital bone.

Function: in the mutual contraction of the two muscles we have! A flexion of the head and neck (fig. H8). By reversing the moving points we have the forced extension of the neck and head (fig. I8). If a only muscle contracts tilts! head from its jato (fig. L8) or it can

rotate it from the opposite side (fig. M).

Front scull (figs. A-B-C 9)

It is located deep behind the sternocleidomastoid.

Origin: from the anterior tubercles of the transverse processes of the 11th, 4th, 5th and 6th cervical vertebrae.

Insertion: in the scalene tubercle on the superior face of the 1st rib.

Medium Scaieno (figs. A-B-C 10)

It is the most voluminous and the longest of the scalenes.

Origin: depending on the individuals with six or seven tendon heads from the posterior tubercles of the transverse processes of the cervical vertebrae.

Insertion: on the upper face of the 1st rib behind the anterior scalene.

Rear scull (figs. A-B 11)

It is the smallest and deepest of the scalenes.

Origin: from the posterior tubercles of the transverse processes of the IV, V and VI cervical vertebrae.

Insertion: on the external surface of the 2nd rib, posterior part.

Function: of the scalene muscles: they erect the neck and consequently the head. If the muscles on one side are contracted, they tilt the cervical tract laterally (fig. L), or by inverting the mobile point they raise the first two ribs.

TAV. II

Fig. A

Lateral view of the suprajoide, subjoide and scalene neck muscles.

so. suprajoidei

i.t. thyroid notch

sott. subjoidei

9. anterior scalenus

10. average scalene

- 11. Posterior scalenus
- s.t. splenia of the head

Figs. B-C-D

Front and back lateral view of the plastic relief of the neck muscles.

- 8. sternocleidomastoid:
 - a. sternal head
 - b. clavicular head
 - c. mastoid head
- 9. anterior scalenus
- 10. average scalene
- 11. Posterior scalenus
- e.s. scapula elevator
- s.t. splenia of the head
(muscle belonging to the deep muscles of the back)
- s.s.t. sernispinal of the head
(muscle belonging to the deep muscles of the darso)
- t. trapezoid

Figs. E-F

Posterolateral and anterolateral view of the valumetric structure of the calla.

- t. trapezoid
- 8. sternacleidamastaid
- f.s. saprasternal fassette
- m.s. sternum dumbbell

Fig. G.

Antero-lateral view of the glue's plastic reliefs.

Fig.H

Bending movements of the glue and the head.

Fig. I

Forced extension movement of the glue and head.

Fig. L

Lateral tilt movement of the head.

Fig. M.
Lateral rotation movement of the head.

Platysma

Like a very thin lamina it radiates obliquely, originating in the upper part of the pectoralis major, crosses the glue and ends immediately behind the mouth opening. Due to its thinness it does not influence the plastic formation of the glue and therefore is not indicated graphically. It should be noted, however, that in the contraction it determines transverse epidermal folds on the glue and at the same time brings down and sideways the opening of the mouth. For this function it can be considered a muscle that contributes to the mimic expressions of the face (see also lesson 51).

The scalene muscles (figs. A-B-C) anterior (9), middle (10) and posterior (11), although located on the deep plane, can be seen laterally between the sternocleidomastoid and the levator scapula.

The volumetric space of the neck

As we have seen, the glue musculature delimits the upper extremity of the thorax and connects with the lower extremity of the head. This space can initially be represented as a cylindrical volume with a curved course, which follows the curved line of the cervical tract, as we can see from the drawing in pl. I, fig. F, where this trend is signaled by the sagittal section plane passing through the manubria of the sternum and the spinous process of the VII cervical vertebra, prominent delta.

The plastic relief of the trapezoid develops on the volume obtained (fig. E) and the anterior triangular area delimited by the sternocleidomastoids, within which the thyroid relief and the oblique suprajoid "floor" of the mandible emerge (figs. F-G). Between the sternocleidomastoid, the trapezoid and the clavicle, the shape is more hollowed out; in fact, in this area, the lateral delta triangle of the glue, the scalene muscles, the levator scapula and the splenia of the head, with their origin and relatively deep

insertion, form a slightly lowered and depressed "floor" on which the plastic relief emerges. of the sternocleidomastoid and trapezia.

Lesson 43

THE SHOULDER MUSCLES

The muscles of the upper limb are divided into muscles of the shoulder, muscles of the arm, muscles of the forearm, muscles of the hand.

The muscles of the shoulder (Plate I) originate from the two skeletal segments of the scapular girdle and from these lead to the upper end of the humerus; consequently exert an action on the shoulder joint, guaranteeing it a pluriaxial movement.

Given their insertion particularly close to the articular head of the humerus, they also have the function of keeping it in continuous contact, both in static and dynamic conditions, with its articular seat, that is, with the glenoid articular face of the scapula, thus ensuring congruence and solidity. They are divided into deltoid (1), supraspinatus (2), infraspinatus (3), small rotunda (4), large rotunda (5), subscapularis (6).

Deltoid (Plate I, fig. A1)

It is the most superficial and bulky muscle in the shoulder region. Given its origin which, at the front, involves the skeleton of the clavicle and then moves to the acromion and, posteriorly, to the lower lip of the spine of the scapula, its robust muscular bundles are divisible into three main portions: clavicular (fig. A 1a), acromial (figs. AB 1b) and scapular (fig. B 1C). The acromial portion presents the greatest relief, expanding over the entire lateral area of the shoulder; The clavicular portion manifests itself anteriorly with a slight convexity and the scapular portion, more flattened, extends over the entire posterior area. With its triangular shape it thus envelops the entire shoulder joint and in part both the muscles of the shoulder and those of the arm (fig. F), determining the convex and expanded relief of the shoulder arch. Due to its insertion in the deltoid imprint (fig. A 1d) of the humerus, its muscle bundles, wedged between the anterior muscles of the arm (biceps and brachialis) and the posterior triceps muscle, converge in the

depressed and lateral line (del braecia) called the bicipital sulcus (fig. E sb): it is a depression that forms a line of demarcation between the anterior and posterior muscles.

Origin: the clavicular portion from the lateral third of the clavicle; The acromial portion from the entire external margin of the acromion; the scapular portion of the lower labrum of the spine of the scapula (figs. A-B).

Insertion: through a short and robust tendon in the deltoid impression of the humerus (fig. A i.d.).

Function: in the simultaneous contraction of all three muscle portions, it raises the arm on the horizontal plane (fig. H) and, in synergy with the upper head of the trapezoid, further raises the upper limb. In the greatest contraction of the clavicular portion, the limb is brought up and forward (Fig. G). If acromial contraction prevails, the limb is carried upwards and laterally; if the scapular portion acts more, the arm is always raised but posteriorly and in the latter case the anterior clavicular portion is antagonistic.

Supraspinatus (fig. D2)

It is small and sturdy, with a triangular shape. It is located on the supraspinatus fossa of the scapula and, passing under the acromion posterior to the coracoid beak, it is inserted on the upper extremity of the humerus.

Origin: supraspinatus fossa of the scapula.

Insertion: upper facet of the greater tubercle of the humerus (see detail Fig. D2).

Function: collaborates with the deltoid in lifting the arm.

Infraspinatus (fig. D3)

Triangular and flattened, it lies on the extended infraspinatus fossa of the scapula. Its bundles lead obliquely towards the superior exterior of the humerus. The muscular is partially visible from the outside, delimited by the trapezoid, the great dorsal and the deltoid.

Origin: infraspinatus fossa of the scapula.

Insertion: middle facet of the greater tubercle of the humerus (detail fig. D3).

Function: contracting, it rotates the humerus outwards along its longitudinal axis.

Small round (fig. D4)

It is a slender cylindrical muscle placed obliquely between the scapula and the humerus.

Origin: from the lateral (axillary) margin of the scapula.

Insertion: lower facet of the greater tubercle of the humerus (see detail Fig. D4).

Function: Rotates the humerus outward and weakly contributes to its adduction.

Large round (fig. D5)

It is placed under the small rotunda, which is also cylindrical, but is longer and more robust. On the lower side it is wrapped by the great dorsal until its insertion (see lesson 41, table II), thus shaping the "posterior pillar" of the wall of the axillary cavity, evident when the upper one is raised. We may note that between the large rotunda and the small rotunda there is a triangular interspace which connects the passage of the long head of the triceps, which originates from the infraglenoid tubercle of the scapula (see fig. D, detail De fig. E c.l.t.).

Origin: from the lower corner of the scapula, lateral margin and short posterior area.

Insertion: anteriorly on the medial crest of the bicipital sulcus of the humerus (see Fig. C5).

Function: rotates the humerus inwards. Adducts the arm and brings it back. If the tip is fixed and on the humerus, it raises the scapula outwards, at the moment when the deltoid in turn raises the arm (fig. H).

Subscapularis (fig. C 6)

Flattened, triangular in shape, it occupies the entire area of the subscapular fossa and its fibers converge laterally in a robust insertion tendon. The muscle is largely hidden, facing against the rib cage and interposed between the scapula and the serratus anterior. It contributes to the formation of the posterior wall of the axillary cavity. Its lateral margin can be seen only when the arm is raised and raised (fig. H).

Origin: from the subscapularis fossa (fig. C6).

Insertion: on the lower tubercle of the humerus (fig. C6).
Function: rotates the humerus inwards and adducts it.

Tav. I

Fig. A

Anterior front view of the muscles of the right shoulder.

c. clavicle

to. acromion

L. deltoid:

to. clavicular portion

b. acromial portion

i.d. impression of the idea

g.p. clavicular portion of the pectoralis major muscle

Fig. B

Posterior view of the muscular system of the right shoulder,
excluding the triceps muscle of the arm.

to. acromion

s. spine of the scapula

there. lower lip of the spine of the scapula

l. deltoid:

b. acromial portion

c. scapular portion

Fig. F

1 deltoid:

b. acromial portion

c. scapular portion

3 infraspinatus

4 small roundabout

5 large roundabout

t. triceps

Fig. C.

Anterior view of the shoulder muscles.

6. subscapularis
d.b. bicipital shower
m.m. medial margin of the shower

Fig D.

Posterior view of the shoulder muscles, excluding the deltoid.

2. supraspinatus
3. infraspinatus
4. small round
5. large round

Detail D

Shoulder Muscle Insertion.

t. m. greater tubercle
you. infraglenoid tuberosity where the long head of the triceps
muscle originates

Fig. E

Lateral view of the muscular system of the shoulder and arm, with
section of the deltoid.

l deltoid
s.b. bicipital sulcus
b. biceps
br. brachialis
t. triceps
c.l.t. long head of the triceps muscle

Figs. G-H

Arm abduction movements on the shoulder.

t. trapezoid

Lesson 44

THE MUSCLES OF THE ARM

They are four long muscles that cover the skeleton of the arm; they originate both from the scapula and from the humerus and are inserted into the upper extremity of the skeleton of the forearm. Thus they act on both the shoulder and elbow joints. They are divided into two groups: the anterior and posterior ones with differentiated functions; the anterior ones perform the primary role of flexors of the forearm on the arm, while the posterior ones act as extensors.

The anterior group consists of three muscles (table I, figs. B-G-H): the biceps (7), the brachiate (8), the coracobrachialis (9).

The posterior group is given by a single muscle (table I figs. G-H): the triceps (10).

The muscle masses of the arm find their greatest development in the transverse direction in the median portion of the humerus, which allows them to come into contact both on the medial side and on the lateral side, thus wrapping the skeletal part. The anterior and posterior muscle groups are placed in close contact, but are in any case separated and contained by two lodges which, like a sheath, incorporate them inside, separating the anterior from the posterior; these lodges are in turn separated by two longitudinal intermuscular septa (fig. E s.i.) which originate along the lateral and medial margin of the humerus starting from the margins of the bicipital sole up to the epicondyle and the epitrochlea. These septa, like two fibrous lamellae, help to expand the area of origin of the muscular bodies, in particular the brachialis and triceps. Both the anterior and posterior loggia connect to the septa creating that characteristic lateral and medial depression that we notice in the arm, called the bicipital sulcus (fig. E sb), visible in the lateral profile that goes from the insertion of the deltoid to the origin of the extensor muscles of the forearm (Fig. H sb) and which leads medially from the axillary cavity to the epitrochlea of the humerus (Fig. G sb). This set of loggias or fascias and septa is defined as a whole as fascia brachiate, so! distinct

from the similar system that covers the musculature of the forearm called the anti-brachial fascia.

Biceps (figs. A-B-C 7)

It is the longest muscle in the arm and is the most superficial of the forelegs. Tapered in shape, it originates with two tendon heads called the long and short of the scapula. Both leaders, in their traits initial, are hidden by the deltoid muscle of the shoulder.

Origin: the long head (figs. A-C 7a) originates with a robust long tendon flattened by the supraglenoid tubercle of the scapula. From here the tendon then flows over the head of the humerus, wrapped in its own synovial sheath, included within the fibrous capsule of the shoulder joint; then emerging from this capsule, it descends into the bicipital sulcus, where it is held by the tendon tape of the pectoralis major. All this also fulfills the mechanical function of holding the joint in place, thus keeping the head of the humerus in contact with the glenoid cavity and also contributing to giving greater strength to the joint system.

The short head (figs. A-C 7b) originates from the coracoid process of the scapula and goes obliquely towards the outside and downwards, until it joins the long head; after the initial tendon tract, the two tendon heads form two initially distinct muscle bellies, which then join together in the fusiform volume of the biceps.

Insertion (figs. AC 7): above the elbow joint, the muscle is transformed into a strong tendon head which inserts into the radial tuberosity and from which a thin tendon lamina branches off, the fibrous point (fig. B l.f.) , which is carried obliquely downwards, fixing itself to the containment band of the flexor muscles of the forearm.

Function: the biceps acts on the two joints. In the shoulder joint the long head causes the abduction of the arm, while the short head causes adduction. In the elbow joint the biceps, as a whole, causes flexion (fig. F7) and supination of the forearm on the upper arm.

Brachialis (figs. A-B-C-D 8)

It is located under the biceps, broad, elongated and slightly

flattened; covers the lower half of the humerus, dilating laterally and medially. Its front face is slightly convex to contain the belly of the biceps (fig. D5). Although it is largely covered by the biceps, its shape appears evident in the margins that protrude from the septa, in particular near the articulation of the elbow.

Origin (figs. A-D 8): immediately under the deltoid imprint, in a vast anterolateral and medial area of the humerus, and from the intermuscular septa. Insertion (figs. A-D 8): in the wrinkled imprint of the ulnar tuberosity.

Function: acts on the elbow joint by strongly flexing the forearm on the upper arm (fig. F8).

Coracobrachialis (figs. A-B-C 9)

It is a thin, elongated muscle that medially accompanies the short head of the bicep, merging with it in the upper extremity.

Origin (fig. A9): from the coracoid process of the scapula, joined to the short head of the biceps.

Insertion (fig. A9): in the middle part of the medial margin of the humerus near the origin of the brachialis.

Function: adducts the arm by bringing it forward.

Triceps (plate II, figs. A-B-C 10)

It covers the entire back area of the arm. It consists of three muscle heads, long, lateral and medial, and a common tendency of insertion. The heads begin to dilate in their plastic relief immediately under the deltoid, while the ribbon-like tendon already appears at the height of the middle of the arm and then extends towards the elbow and is slightly depressed, especially in the contraction of the muscular bellies that surround it.

Origin: the head lunge (figs. A-B 10a) from the infraglenoid tuberosity of the scapula; the lateral head (figs. A-B 10b) from the posterior aspect of the humerus, immediately under the greater tubercle; the medial head (figs. A-B 10c) from the posterior and medial aspect of the humerus, in correspondence with the medial intermuscular septum.

Insertion (figs. A-B 10): through a strong and flat tendon in the top of the olecranon of the ulna.

Function: Overall extends the forearm over the upper arm. The

head lunge, being the only one originating from the shoulder blade, collaborates in the adduction of the arm. In the contraction of the muscular bodies, the bellies of the lateral head and the lunge head are highlighted.

Tav. I

Fig. A

Frontal view of the right upper limb origin and insertion and muscle trajectories: shoulder-arm forearm-hand.

Shoulder muscles.

- 1a. deltoid- clavicular portion
- 1b. acromial portion
- 2. supraspinatus
- 5. large round
- 6. subscapularis

Arm muscles

- 7. biceps:
 - a. long head
 - b. short head
- 8. brachialis
- 9. coracobrachialis

Muscles of the forearm.

- 11. round pronator
- 12. radial flexor carpus
- 13. handheld long
- 14. ulnar flexor carpus
- 15. superficial flexor of the fingers
- 16. deep flexor of the fingers
- 17. own flexor of the thumb

Fig. B

Frontal view of the plastic relief of the apparatus muscle of the right upper limb.

10b. lateral head triceps muscle

10c. head medial triceps muscle

l.f. fibrous fragment

Fig. C.

Muscular apparatus of the right upper limb in the anterior view, excluding the deltoid and the superficial muscles of the forearm.

Fig. D

The brachiate muscle and section of the biceps insertion tendon.

Fig. E

Detail in anterolateral view of the loggias and septa intermuscular of the arm (transverse section at the level of the lower portion of the right arm).

s.i. intermuscular septum

s.b. bicipital sulcus

you. ulnar tuberosity

u. ulna

o. humerus

Fig. F

Flexion movement of the forearm on the upper arm.

10a. long head triceps muscle

s.b. bicipital sulcus

Fig. G

Medial view of the plastic relief of the muscular system of the right upper limb.

s.b. bicipital sulcus

S.i. epitroclea

o. olecranon

Muscles of the forearm.

23. common extensor of the fingers

25. ulnar extensor carpus

Fig. H

Lateral view of the relief model of the muscular system limb on the upper right.

Fig. I

Lateral view of the limb superior: origin, insertion e muscle trajectories.

1c. deltoid - scapular portion

3. infraspinatus

4. small round

19. brachioradialis

20. Long radial extensor carpus

21. Extensor radialis brevis carpus

23. common extensor of the fingers

26. anconeus

27. long abductor of the thumb

28. short extensor of the inch

29. long extensor of the thumb

30. extender own index

Table II

Fig. A

Posterior frontal view: origin and insertion of the muscles of the right upper limb.

Fig. B

Posterior frontal view of the plastic relief of the muscular system of the right upper limb.

Shoulder muscles.

- 1b. deltoid - acromial portion
- 1c. deltoid - scapular portion
- 2. supraspinatus
- 3. infraspinatus
- 4. small round
- 5. large roundabout

Arm muscles.

- 7. biceps
- 10. triceps (tendon)
 - a. long head
 - b. lateral head
 - c. medial head

Muscles of the forearm.

- 14. ulnar flexor carpus
- 19. brachioradiale
- 20. Long radial extensor carpus
- 21. Extensor radialis brevis carpus
- 23. common extensor of the fingers
- 24. proper extensor of the mignolo
- 25. ulnar extensor carpus
- 26. anconeus
- 27. long abductor of the thumb
- 28. short extensor of the thumb
- 29. long extensor of the thumb
- 30. own index writer

Fig. C.

Posterior view of the isolated triceps muscle.

Fig D.

Anterior view of the abduction movement in extension of the right upper limb, and flexion of the forearm; and we can notice the plastic relief of the muscles of the axillary cavity and of the muscles of the arm.

7. biceps

8. brachialis

9. coracobrachialis

d. deltoid

g.p. large pectoral

g.r. large round

g.d. great dorsal

Lesson 45

THE MUSCLES OF THE FOREARM: THE EPITROCHLEAR GROUP

The complex muscle system of the forearm originates in the lower extremity of the humerus and in the skeletal segments of the forearm, radius and ulna. Generally, they are fusiform bodies with long tendons that reach the carpus and the fingers of the hand. Extending from the humerus to the carpus and in some cases to the fingers, they are able to act on the joints of the elbow, wrist and fingers; consequently, they oversee all the multiple movements of the arm, forearm and hand segments. Altogether there are twenty, arranged in layers placed on the front, side and rear. To facilitate understanding, we will first divide them - based on their origin on the elements of the skeleton and their function - into two distinct muscle masses: an anterior medial and a posterior lateral.

The medial anterior muscle mass belongs to the muscle group of the epitrochlear muscles (Table I, Figs. AC a), which, originating from the epitrochlea of the humerus, lead to anterior and medial coverage of the forearm and, given their insertion into the carpus and in the hand, they assume the role of flexors of the forearm on the arm and of flexors and pronators of the hand. The epitrochlear group can be divided into superficial anterior flexor muscles and deep anterior flexors.

The lateral and posterior mass belongs to two groups: the epicondylar muscles, in turn divided into lateral extensors (figs. AB-C1.) And superficial posterior extensors (figs. BC ps), and the small group of deep posterior extensors (figs. . BC pp).

The epicondylar muscles originate from the epicondyle and the epicondylar crest of the humerus, moving laterally and posteriorly on the radius, carpus and fingers of the hand. They operate as supinators and extensors of the hand; they thus act as antagonists of the epitrochlear muscles, which occupy the anterior plane of the forearm and hand.

The small group of deep posterior extensors, placed between the

lateral and superficial posterior ones, emerges laterally near the wrist and carries its own tendons on the thumb and index finger, acting exclusively on these fingers, with the function of extending and abduct the thumb and extend the index finger.

TAV I.

Fig. A

Anterior front view of the muscle groups of the right forearm.

- e. epitroclea
- a. plastic relief of the epitrochlear group: the superficial and deep anterior flexor muscles
- 1. plastic relief of the epicondylar group: the lateral extensor muscles.

Fig. B

Side view.

- p.s. plastic relief of the epicondylar group: the superficial posterior extensor muscles
- p.p. plastic relief of the small group of the deep posterior extensor muscles

Fig. C.

Front rear view.

Fig. D

Muscular apparatus of the forearm or superficial anterior flexor muscles.

- 11. round pronator
- 12. radial flexor carpus
- 13. handheld long
- 14. ulnar flexor carpus
- p. pisiform bone
- a.p. palmar aponeurosis

Fig.E.

Frontal view of the muscle groups of the right upper limb. Front and side muscles of the forearm:

- l.t. transverse ligament of the wrist
 - 11. round pronator
 - 12. radial flexor carpus
 - 13. handheld long
 - 14. ulnar flexor carpus
 - 15. Superficial flexor of the fingers
 - 16. deep flexor of the fingers
 - 17. long flexor of the thumb
 - 19. brachioradialis
 - 20. Long radial extensor carpus
-

EPITROCLEAR: SUPERFICIAL ANTERIOR FLEXORS

The superficial anterior flexors are the pronator teres (11), the radial flexor of the carpus (12), the long palmar (13), the ulnar flexor of the carpus (14).

Round pronator (figs. D-E 11)

It is located in the upper part of the forearm; cylindrical in shape, it descends obliquely from the medial to the illateral side. In its short trajectory it passes over the brachialis and enters the skeleton of the radius below the brachioradialis.

Origin: epitrochlea of the humerus.

Insertion: lateral face of the radius.

Function: pronation of the forearm; it acts on the upper radio-ulnar joint and contributes to the flexion of the forearm on the upper arm.

Radial carpus flexor (figs. D-E 12)

It is a bulky muscle, located just below the pronator teres. It has a tapered body in the upper half of the forearm and a sturdy tendon in the lower half.

Origin: epitrochlea of the humerus.

Insertion: passing with the tendon under the transverse lig (fig. E l.t.), it is inserted on the palmar side of the base of the second metatarsal.

Function: flexes the palm of the hand on the forearm (see fig. G12) and contributes to pronation. It also contributes to the radial abduction movement of the carpus.

Long palm (figs. D-E 13)

Equipped with a slender, fusiform and short muscular body, interposed between the radial flexor and the ulnar flexor of the carpus. It is prolonged by a thin tendon which passes over the transverse wrist region.

Origin: epitrochlea of the humerus.

Insertion: with a subtle tendon expansion in palmar aponeurosis (fig. D a.p.).

Function: Weakly flexes the palm of the hand on the forearm and stretches the palmar aponeurosis.

Ulnar carpal flexor (figs. D-E 14)

Located above the ulna, it is the muscle which determines the slightly convex volume of the medial margin of the forearm.

Origin: from the epitrochlea of the humerus and from the posterior margin of the ulna.

Insertion: in the pisiform bone of the carpus (fig. D p.).

Function: flexes the palm of the hand on the forearm collaborating in this action with the radial flexor of the carpus (see fig. G 14); it also contributes to the ulnar abduction movement of the hand.

EPITOCLEARS: DEEP ANTERIOR FLEXORS

The deep anterior flexors are placed under the superficial layer muscles (to compare the origin and insertion of the forearm muscles, both epitrochlear and epicondyle, (see also lesson 44) and are the superficial flexor of the fingers (15), the deep flexor of the fingers (16), the long flexor of the thumb (17}, the square

pronator (18).

Superficial flexor of the fingers (figs. E-F 15)

It is the most developed muscle of the anterior, with a dilated shape over the entire radio-ulnar area. Above the radio-ulnar joint begins its tendon tract divided into four tendons (see detail Fig. F l.t.), which flow into the carpal canal passing under the transverse lig; in the palmar area they fan out in the direction of the 2nd, 3rd, 4th and 5th fingers.

Origin: from the epitrochlea of the humerus, from the upper extremity of the ulna and from the anterior face of the radius (see also lesson 44, plate I, figs. A-C 15).

Insertion: in correspondence with the first phalanges the tendons fork into two heads which are inserted into the palmar face of the second phalanges (fig. F15). It should be noted that this bifurcation of the superficial flexor tendon allows the passage of the tendon of the deep flexor muscle below it, since the two tendons run parallel, one below the other, throughout the palm of the hand. The deep flexor will then find its insertion into the base of the III phalanx (see particular fig. F 15, 16).

Function: flexes the palm on the forearm and in particular the second phalanges on the first, from the 2nd to the second finger.

Deep flexion of the fingers (figs. E-F 16)

Less developed than the previous one, and entirely covered by the superficial of the fingers. Not being visible, and indicated only in the last tendon tract passing through the bifurcation of the superior flexor tendon of the fingers

Origin: from the anterior face of the ulna on the upper two thirds and from the interosseous membrane.

Insertion: as already indicated in the relation with the superficial of the fingers (fig. F16), it finds insertion in the bases from the palmar

side of the third phalanges of the 2nd, 3rd, 4th and second finger.

Function: flexes the third phalanges on the second, from the 2nd to the 5th finger, collaborating with the superficial flexor muscle in the complete flexion of the same fingers.

Long thumb flexor (figs. E-F 17)

It is a thin, flattened muscle located lateral to the deep flexor muscle of the fingers; it lies on the surface of the superficial flexor of the fingers and is covered in the upper portion by the brachioradialis muscle. Above the radioulnar joint it transforms into a tendon which passes under the transverse ligament (fig. F l.t.) and the opposing muscle of the thumb, which is mainly responsible for the characteristic relief of the palm called eminence thenar (fig. F et).

Origin: from the anterior aspect of the radius and from the interosseous membrane.

Insertion: Base of the second phalanx of the thumb.

Function: thumb flexion.

Pronator quadratus (18)

Short flat muscle, quadrangular in shape, connects to the ulnae at the radius in the distal end.

None shown, being located under the long flexor of the thumb and the deep flexor of the fingers.

Fig. F

Lower portion of the deep anterior flexor muscles.

l.t. transverse ligament

e.t. eminence thenar of the palm

e.i. hypotenar eminence of the palm

15. inferior portion of the tendons of the superficial flexor muscle

of the fingers

16. passage of the deep flexor tendon of the fingers within the tendon branch of the superficial flexor of the fingers. (L)

17. inferior portion of the long flexor muscle of the thumb

Detail Fig. F

Lateral view of the metacarpal and the finger: thus the path and insertion of the tendons of the deep and superficial flexors of the fingers are visible.

Fig. G

Studies on flexion and semi-pronation movements of the forearm and right hand investigated starting from the volumetric traces up to the identification of muscle masses.

(1)

on the third finger the tendon of the deep flexor of the fingers is excluded; thus the tendon insertion of the superficial flexor of the fingers is observed

Lesson 46

FOREARM MUSCLES: THE GROUP OF EPICONDYLOIDES

EPICONDYLOIDES: LATERAL EXTENSORS

These are the muscles that combine to create the raised profile of the entire mid-upper area of the forearm and of the lower arm. They are called brachioradialis (19), long radial extensor carpus (20), radial short extensor carpus (21), supinator (22)

Brachioradialis (plate I, figs. A-D-E 19)

It is the longest and most voluminous muscle of the lateral sides; descends with a twisting movement along the latero-anterior margin of the radius. In the middle of the forearm it transforms into a sturdy cylindrical tendon; with its shape it determines the lateral margin of the so-called cubital fossa (see fig. G f.c.).

Origin: from the supracondylar crest of the inferior lateral margin of the humerus and from the lateral intermuscular septum (Fig. A19).

Insertion: in the styloid process of the radius (Fig. A19).

Function: brings the forearm into semi-pronation (see fig. G); in this position he flexes on his arms.

Long radial carpus extensor (Figs. B-D-E 20)

It is placed immediately under the brachioradialis and follows its trajectory laterally. Flattened in shape, it develops its tendinous part in the middle of the forearm.

Origin: above the epicondyle of the humerus, immediately below the origin of the brachioradialis (fig. B20).

Insertion: by deeply crossing the postero-lateral area of the inferior radio-ulnar joint, it moves with its tendon to the dorsal aspect of the base of the second metacarpus (fig. B20).

Function: and supinator and hand wrist extensor. In the radioulnar joint it collaborates in the abduction movement of the hand.

Short radial extensor carpus (figs. B-D21)

Located posteriorly, and surrounded, and partly covered, by the radial extensor lungo and the common extensor of the fingers. Its shape is fusiform and flattened.

Origin: from the epicondyle of the humerus.

Insertion: the tendon deeply crosses the posterior area of the lower radio-ulnar joint and enters the dorsal aspect of the base of the third metacarpus (Fig. B21).

Function: hand wrist extension.

Supinator (22)

It is a short muscle interposed deep between the radius and the epicondyle of the humerus.

It is not represented here, being entirely hidden.

Tav. I

Fig. A

Anterior frontal view of the muscular apparatus of the right forearm: the group of epicondyloids; the lateral extensor muscles.

19. branchioradialis

20. Long radial extensor carpus

Fig. B

Front rear view.

20. Long radial extensor carpus

21. Extensor radialis brevis carpus

Fig. C

Posterior view of the plastic relief of the muscular apparatus of the right upper limb.

Posterior and lateral muscles of the forearm.

l.d. dorsal ligament

19. brachioradialis

20. Long radial extensor carpus

21. Extensor radialis brevis carpus

23. common extensor of the fingers

24. Extensor of the little finger

25. ulnar extensor carpus

26. anconeus

27. long abductor of the thumb

28. short extensor of the thumb

29. long extensor of the thumb

30. Extender of the index

Figs. D-E

Lateral and anterior view of the muscles of the right forearm.

11. round pronator

12. radial flexor carpus

13. handheld long

14. ulnar flexor carpus

15. Superficial flexor of the fingers

17. long flexor of the thumb

Fig. F-G

Anterolateral and posterolateral views of the behavior of the muscle masses in the flexion and extension of the forearm on the arm in semipronation.

f.c. cubital fossa

Lesson 47

FOREARM MUSCLES: THE GROUP OF EPICONDYLOIDES AND THE GROUP OF DEEP POSTERIOR EXTENSION MUSCLES

EPICONDYLOIDES: REAR SURFACE EXTENSORS

They line the posterior wall of the forearm and determine the extension movements of the palm and fingers, becoming the antagonists of the anterior muscles. They are the common extensor of the fingers (23), the proper extensor of the little finger (24), the ulnar extensor of the carpus (25), the anconeum (26).

Common finger extensor (Table I, fig. A23)

It has a long and flattened muscular belly; on the lower third of the forearm it gives rise to four tendons which run under the dorsal leg and diverge on the dorsal side of the hand, reaching the phalanges from the 2nd to the 3rd finger. Note that the 5th finger tendon merges with the extensor tendon of the little finger. On the back of the palm all four tendons are spaced and held in place by three intertendinous joints (fig. At.).

Origin: from the epicondyle of the humerus.

Insertion: at the base of the II and the phalanx (see also lesson 48, table 1, fig. B and detail fig. B).

Function: Extend the fingers of the hand and spread them. It also causes dorsal extension and ulnar abduction of the hand.

Extensor of the little finger (fig. A24)

It is present in the same origin as the common extensor of the fingers and is joined to it for a long distance, but it is distinguished near the lower radio-ulnar joint, where it becomes tendon. Like the common extensor, the tendon has insertion into the phalanges of the little finger.

Extensor carpi ulnar (Fig. A25)

Elongated and fusiform, it runs parallel to the extensor of the little finger, passing over the posterior aspect of the ulna.

Origin: from the epicondyle of the humerus together with the common extensor of the fingers and from the posterior aspect of the ulna.

Insertion: with the tendon it passes into the longitudinal sulcus of the styloid process of the ulna. It continues under the dorsal ligament and reaches the base of the fifth metacarpus (see particular fig. A25).

Function: determines the extension and ulnar abduction of the hand. In this last movement it collaborates with the ulnar flexor of the carpus.

Anconeus (see lesson 46, plate I, fig. C26)

It is the shortest of the hindquarters, flat and triangular in shape; and located obliquely between the epicondyle of the humerus, the olecranon of the ulna and the extensor carpi.

Origin: from the posterior aspect of the epicondyle.

Insertion: under the olecranon, in the posterior aspect of the ulna.

Function: assists the triceps in extending the forearm over the upper arm.

THE DEEP POSTERIOR EXTENSOR MUSCLES

They are called long abductor of the thumb (27), short extensor of the thumb (28), long extensor of the thumb (29), extensor of the index finger (30).

They are placed in the deep posterior aspect of the forearm. They appear in the inferior tract near the inferior radiocarpal joint on the posterior-posterior area towards the thumb and index finger. They remain under the common extensor of the fingers and are carried over the tendons of the long and short radial extensor of the carpus. Their length is short, given the origin in the forearm; they are flattened and equipped with a long tendon.

Long abductor of the thumb (figs. A-B 27)

Origin: from the posterior aspect of the ulna, from the interosseous membrane and partly from the posterior aspect of the radius.

Insertion: at the base of the first metacarpus (see detail fig. A27).

Function: abducts hand and thumb.

Short thumb extensor (figs. A-B 28)

With its tendon delineated at the top a depressed triangular area (see particular fig. B ta) called "anatomical snuffbox" (here, in fact, it was customary in the past to place a small pinch of snuff), a space that is even more deep in the contraction of the muscles that surround the sides.

Origin: under the long abductor in the same area as the previous one.

Insertion: at the proximal end of the 1st phalanx of the thumb (see detail Fig. A28).

Function: Extends and abducts the thumb.

Long thumb extensor (figs. B-A 29)

Since the tendon is slightly lower and distanced from the tendon of the extensor brevis of the thumb, it delineates the depressed area of the "anatomical snuffbox" below.

Origin: on the posterior aspect of the ulna and on the interosseous membrane. Insertion: in the proximal end of the second phalanx of the thumb (see detail fig. A29).

Function: extends the II phalanx of the thumb over the I.

Index extender (figs. B-A30)

It can be seen on the branch of the first two tendons of the common extensor of the fingers directed on the index and middle fingers.

Origin: on the posterior aspect of the ulna.

Insertion: Fuses with the common extensor tendon of the fingers directed to the index.

Function: extends the index independently of the other fingers.

Fig. A

Posterior view of the epicondylar group of the right forearm:
superficial posterior extensor muscles and of the deep posterior
extensor group Superficial posterior:

- 23. common extensor of the fingers
- 24. Extensor of the little finger
- 25. ulnar extensor carpus

Deep hindquarters:

- 27. long abductor of the thumb
- 28. short extensor of the thumb
- 29. long extensor of the thumb
- 30. Extender of the index
- t. intertendinous joints

Detail Fig. A

Posterior view of the path and tendon insertions in the manus
skeleton.

- 20. Insertion of the extensor radial long carpus
- 21. insertion of the extensor radialis brevis carpus
- 25. insertion of the ulnar extensor carpus
- 27. insertion of the abductor longus muscle of the thumb
- 28. insertion of the extensor brevis muscle of the thumb
- 29. insertion of the extensor long muscle of the thumb

Fig. B

Posterior view of the deep posterior extensor muscle group.

Detail Fig. B

Hand thumb finger tendon pads.

t.a. anatomical snuffbox

Figs. C-C '

Differentiated points of view of the behaviour of the plastid reliefs of the muscles in the flexion movement of the forearm on the arm with semipronation, pronation and supination of the hand.

Lesson 48

THE MUSCLES OF THE HAND

In addition to the tendons of the forearm muscles that are inserted into the hand, let's now observe those small muscles that contribute to the movements of the fingers and that determine the plastic volume of the palm.

The own muscles of the hand are divided into three groups: muscles of the intermediate palm, muscles of the lateral palm, muscles of the medial palm.

The intermediate palm group corresponds to the interosseous spaces of the metacarpus from which it forms the thickness of the palm. These muscles can be seen on the dorsal side between the metacarpal bones and the tendons of the extensor muscles of the forearm, while anteriorly they are covered by the tendon lamina of the palmar aponeurosis.

The lateral group covers the first metacarpal bone, part of the II and III

metacarpus, determining that muscular relief, placed on the side of the thumb called the thenar eminence (fig. A e.t.). The medial group covers the fifth and upper part of the fourth metacarpus and participates in the formation of the relief, less accentuated than the previous one and placed on the side of the little finger, called the hypotenar eminence (fig. A e.i.).

THE MUSCLES OF THE INTERMEDIATE PALM

They are divided into: dorsal interosseous muscles (1), palmar interosseous muscles (2), lumbrical muscles (3).

Dorsal interossei

They are four small bipinnate muscles. Origin (table I, figs. B-C 1): from the adjacent surfaces of the diaphysis of the metacarpal

bones.

Palmar interossei

They are usually four in number, but in some individuals only three can be counted. Origin (plate I, figs. C-D 2): from the palmar surfaces of the metacarpal bones (fig. C).

Lumbrical

They are also four, narrower and thinner. Origin (pl. I, fig. E3 and pl. 11 fig. B3): from the tendons of the deep flexor of the fingers.

Insertion: all the muscles of the intermediate palm end by thinning in small tendons that are carried on the phalanges of the 2nd, 3rd, 4th and second finger (table I figs. DC) and with small additional bundles they also insert into the dorsal digital expansion (see fig. B and d) of the four tendons of the common extensor muscle of the fingers. To clarify this last tip, it should be noted that the tendon of the common extensor of the fingers, starting from the joint between metacarpus and phalanges, has the particularity of being connected to the interosseous muscles through a small triangular tendon blade, the dorsal digital expansion. (detail fig. B and d), which is an arch of fibres that surrounds both the metacarpophalangeal joint and the phalanx of the fingers. This system of lateral tie rods allows greater control over the precision movements that the hand can perform: in fact the interosseous muscles act on the adduction movement of the fingers, where the palms will be involved, while the opposite movement of abduction and flexion of the I phalanx, from the 2nd to the second finger, the lats are responsible (plate I, fig. A). The tendon of the long extensor of the fingers, moreover, before finding insertion at the base of the second phalanx with its main head, divides, thus creating two lateral heads which, reuniting, become inserted at the base of the second phalanx (Table I, detail fig. B)

Tav. I

Fig. A

Frontal view of the left hand and finger movements.

e.t. thenar hernia

e.i. Hypotenar hernia

Fig. B

Posterior or dorsal view of the skeleton and muscles of the right hand: group of the intermediate palm.

1. dorsal interossei

1 a. head of lateral origin

1 b. head of origin of the I dorsal interosseous

2. palmar interossei

Detail Fig. B

Lateral and dorsal view of the dorsal digitate expansion of the middle finger of the right hand.

II m.c. II metacarpal

I-II-III f. phalanges

t. tendency of the common extensor of the fingers

e.d.d. digital backbone expansion

1. dorsal interpose

3. lumbricals

c.p. main tendon head of the common extensor of the fingers
(insertion)

c.l. lateral tendon head of the common extensor of the fingers
(insertion)

l.t.m. transverse ligament of the heads of the metacarpals

Fig. C

Anterior or palmar view of the interosseous muscles of the right hand.

1. dorsal interossei
2. area of origin of the palmar interosseous muscles

Fig. D

Palmar view of the interosseous muscles of the right hand.

l.t.m. transverse ligation of the heads of the metacarpals

1. dorsal interossei
2. palmar interossei

Fig. E

Dorsal view of the muscular system and overall tendon of the right hand.

l.d. dorsal ligament

1. dorsal interossei
3. lumbrical
- 7b. transverse head of the adductor of the thumb
8. abductor of the little finger

Fig. F

Dorsal view of the plastic relief of the muscles and tendons of the right hand

THE MUSCLES OF THE LATERAL PALM: EMINENCE TENAR

Starting from the most superficial, they are called: abductor brevis of the thumb (4), flexor brevis of the thumb (5), opponens of the thumb (6), adductor of the thumb (7).

The short abductor and short flexor muscles are the most superficial and originate from the robust tendon bundles of the transverse carpal ligament and, as regards the abductor, albeit to a small extent, also from the tubercle of the scaphoid and trapezium (plate II, fig. B4). Of these muscles, the short flexor can be divided into two original heads, one superficial and one deep. The superficial one originates from the transverse ligament (fig. B5), while the deep one originates from the bones of the carpal skeleton, the trapezium and the capitate.

The opposing muscle (figs. A-B 6) occupies the intermediate plane, while the adductor, with its two oblique and transverse heads, is placed in the deep plane of the palm of the hand.

The oblique head (fig. A 7a) originates from the bases of the II and III metacarpal.

The transverse head (figs. A-B 7b) originates from the palmar surface of the diaphysis of the III metacarpal.

Insertion: the opponens moves into the distal end of the first metacarpus (fig. A6) while the other muscles are inserted at the base of the first phalanx (fig. B 5-6-7).

Function: the muscles act on the carpometacarpal saddle joint and on the metacarpophalangeal joint of the thumb, determining the actions of abduction, adduction and flexion (see table II, fig. C).

THE MUSCLES OF THE MEDIAL PALM: EMINENCE HYPOTHENAR

Starting from the most superficial are the abductor of the little finger (8), the short flexor of the little finger (9), the opponens of the little finger (10).

Origin: this series of muscles originates from the transverse carpal ligament (plate II, figs. A-B Lt.) and partly also from the carpal bones, the uncinatum and the pisiform (figs. A-B 8-9-10).

Insertion: carried on the fifth metacarpus and on the base of the first phalanx of the little finger.

Function: the abductor moves the 5th finger laterally, away from the IV. The flexor flexes the little finger on the palm of the hand. The opponens brings the fifth metacarpal towards the palm of the hand, helping to accentuate the concavity of the palm itself.

These muscles are superimposed on the palmar brevis muscle (11), which is a cutaneous muscle with the fibres oriented transversely

(fig. D11), so that, by contracting, it creates a greater concavity of the palm, thus accentuating the relief of the hypotenar eminence.

On the more superficial plane, this complex stratification of muscular elements is completed by the palmar aponeurosis (fig. D a.). It is a robust and thick triangular fibrous lamina which originates from the tendon of the long palmar muscle; starting from the transverse carpal ligament, where it is partially fixed, the aponeurosis spreads out like a fan, dividing into four main longitudinal bundles in the direction of the fingers of the palm of the hand. These find their insertion, on a deep plane, both with the transverse binding of the heads of the metatarsal bones (fig. B l.t.m.) and with the lining phases of the metatarsophalangeal joints, while on a more superficial plane they are fixed to the skin of the palm of the hand. These longitudinal bundles are contrasted by a numerous series of horizontal fibres that keep these four main cords tied together.

The analysis we have carried out on the muscle and tendon reliefs of mana allows us to identify the points where the structural element of the skeleton interacts with the part of muscle volume. Thus we note that the skeleton is present almost exclusively in the dorsal aspect of the mana, furrowed by the passage of the tendons of the extensor muscles. It is also evident in the relief of the heads of the metacarpals (plate III, fig. A t.m.) and the dorsal part of the phalanges. In the palmar face, on the other hand, thickened by the sum of the muscles of the eminence thenar, hypothenar and palm intermedin, the skeleton is not visible. In table III finally we see, in various sequences, how it is possible to pass from an investigation of essential structural volumes to a plastic reinterpretation of the forms in the various postures.

TAV. II

Fig. A

Palmar view of the muscles of the deep and intermediate layer of the thenar and hypotenar eminence.

l.t. transverse carpal ligament

- 6. opponens of the thumb
- 7a. oblique head of the adductor of the thumb
- 7b. transverse head of the adductor of the thumb
- 10. opponens of the little finger

Detail Fig. A

Transverse section of the bones of the lower carpal row: we can see the arrangement of the tendons of the flexor muscles inside the carpal tunnel.

- t. trapezoid
- tr. trapezoid
- ca. happened
- u. hooked

Fig. B

Palmar view of the muscular apparatus of the hand (with the exclusion of the most superficial layer composed of the palmar aponeurosis and the short palmar).

Forearm muscles:

- f.s.d. superficial flexor of the fingers
- f.l.p. long flexor of the thumb
- f.r.c. radial flexor carpi
- l.t. transverse ligament
- f.u.c. ulnar flexor of the carpus

Hand muscles:

- 1. dorsal interossei
- 2. palmar interossei
- 3. earthworms
- 4. abductor brevis of the thumb
- 5. short flexor of the thumb
- 6. opponens of the thumb
- 7b. transverse head of the adductor of the thumb
- 8. abductor of the finger
- 9. Short flexor of the little finger
- 10. opponens of the finger
- g. fibrous sheath that contains the tendon of the deep and superficial flexor of the fingers; is divided into:
 - g.a. annular sheath

g.c. cross sheath

Fig. C

Movements of the fingers of the right hand.

Fig. D

Anterior view of the right hand seen in the superficial muscular relief.

e.t. eminence thenar

e.i. hypotenar eminence

a. palmar aponeurosis

11. palmar short muscle

p.l. long palmar muscle tendon

Fig. E

Anterolateral view of the hand. Plastid volume reconstruction sequence.

1. synthetic volume

2-3. plastic relief of the hand seen in the opposing movement of the thumb

Fig. F

Antero-medial view of the hand.

t.u. epidermal relief of the head of the ulna

1. volume

2. flexion movement

3. forced flexion of the hand

TAV. III

Fig. A

Analysis of some flexion and extension movements of the fingers.

t.m. heads of the metacarpals

Fig. B

Antero-medial view of the right mana.

Fig. C

Posterolateral view of the right mana.

t.a. "anatomical snuffbox", delimited by the tendons of the short and long extensor of the thumb

1. short extensor of the thumb

2. long extensor of the thumb

Lesson 49

STRUCTURE AND PLASTIC SHAPES OF THE UPPER LIMB

Let's now pass from the analysis of the single skeletal and muscular elements of the upper limb to the study of the "perimeter frame" which identifies the overall three-dimensional and plastic shape.

We will initially identify the transverse width of the elbow, between the two extreme points of the skeleton: the epicondyle (table I, figs. A-B 1) and the epitrochlea (figs. A-B 2). The width thus obtained allows us to define, together with the height that goes from the elbow (figs. AB 1-2) to the acromion of the scapula (figs. AB 3), the longitudinal perimeter of the arm and shoulder, which provides the basic structure for identifying the edges of the biceps (fig. A b.), deltoid (figs. AB d.) and triceps (fig. B t.).

From the width of the elbow it is also possible to determine the skeletal perimeter of the forearm which reaches up to the extreme points of transverse width of the wrist, given by the styloid process of the radius (figs. AB 4) and from the head of the ulna (figs. AB 5).). From the latter we proceed to the definition of the perimeter of the hand, divided in turn into two smaller perimeters which identify the palm and fingers. To this initial orientation of the forearm and hand we will connect the main perimeter trajectories of the various muscle groups of the forearm which are:

- the epitrochlear group: superficial anterior flexor muscles (figs. A-B a.);
- the epicondylar group: lateral extensor muscles (figs. AB 1.) and superficial posterior muscles (fig. B p.).

From this two-dimensional observation we pass to a three-dimensional view and analyse the thickness and dilation of the muscle volume (fig. C). It can be seen that the segment of the arm is developed more in its thickness than in its width, while the segment of the forearm finds the greatest expansion in the

direction of the width at the elbow, and then, however, gradually narrows, almost to flatten itself. at the extremity of the wrist. Finally, we note how the flattened and slightly concave volume of the palm of the hand, whose point of greatest thickness is given by the heads of the metacarpals, develops tapered up to the ends of the fingers. This system helps us to understand the form in its essential volumes, and allows us to manage it when facing foreshortened visions with particularly elaborate combinations of movement.

Let us now analyse the behaviour of the muscle masses in the supination and pronation movement (as regards the skeletal part, see lesson 32). We observe in the tables. II and III the complex course that goes from supination to semipronation and pronation of the forearm, and as from an initial structural principle we can proceed to model the shape in its plastic reliefs.

TAV. I

Figs A-B

Frontal anterior and posterior view of the right upper limb seen as skeletal and muscular perimeter frame for the proportional relationships between the parts we can refer to lesson n° 37 on the relationships of the skeleton of the upper limb.

1. epicondyle
2. epitrodea
3. acromion
4. styloid process of the radius
5. head of the ulna
- d. deltoid
- b. biceps
- t. triceps

Epitrochlear muscles:

- a. anterior flexors

Epicondylar muscles:

- l. lateral extensor muscles
- p. posterior extensor muscles

Fig. C

Anterolateral view of the right upper limb seen as a volumetric structural frame in relation to the muscular plastic forms

TAV. II

Figs. A-B-C

Movement in sequence, from semi-pronation to pronation in anterior and posterior frontal vision.

- 1a. deltoid - clavicular portion
- 1b. deltoid- acromial portion
- 1c. deltoid- scapular portion
- 7. biceps
- 8. brachialis
- 9. coracobrachialis
- 10. triceps
 - a. long head
 - b. lateral head
 - c. medial head
- 11. round pronator
- 12. radial flexor carpus
- 13. handheld long
- 14. ulnar flexor carpus
- 17. long flexor of the thumb
- 19. brachioradialis
- 20. long radial extensor
- 21. short radial extensor
- 23. common extensor of the fingers
- 24. Extensor of the little finger
- 25. ulnar extensor carpus
- 27. long abductor of the thumb
- 28. short extensor of the thumb
- 29. long extensor of the thumb
- i.d. first dorsal interosseous

opp. opponent of the thumb
ab.p. short abductor of the thumb
ad.p. adductor of the thumb
ab.m. abductor of the little finger.

Fig D.

Posterior-lateral view of the right limb. Volumetries and muscle reliefs in the various phases, from supination to pronation.

Fig D.

Antero-medial view of the muscle groups of the forearm in the pronation movement.

l. epicondylus: lateral extensors
p. epicondyloids: posterior extensors
a. epitrochlear: anterior flexors

Fig. E

Volumetry of the right upper limb in torsion in the movement from supination to pronation.

TAV. III

Figs. A-B

Medial vision of the muscular apparatus of the forearm in the flexion movement on the arm and of the semipronation and pronation of the manus.

7. biceps
8. brachialis
10. triceps
11. round pronator
12. radial flexor carpi
13. long palm
14. ulnar flexor carpi
19. brachioradialis
20. Long radial extensor carpi
23. common extensor of the fingers
27. long abductor of the thumb

28. short extensor of the thumb

29. long extensor of the thumb

Figs. C-D

Lateral view of the muscular apparatus of the forearm in the flexion movement on the arm and of semipronation and pronation of the manus.

21. Extensor radialis brevis carpi

25. ulnar extensor carpi

(1) The pronator rotunda muscle is excluded to locate the insertion of the biceps

Lesson 50

SKIN MUSCLES OF THE HEAD: CRANIAL VAULT, EYELIDS AND NOSE

The muscles of the head can be divided into two main groups: skin or face muscles and chewing muscles.

The cutaneous muscles originate from the skeleton of the head, covering it from the posterior region of the nape to the anterior region of the face; one of them, in particular, the platysma, a thin and superficial muscle, also covers the region of the glue. They insert into the skin, merging with it. Generally they are divided into two categories: flat and wide muscles, which cover the large skeletal surfaces of the cranial vault, and thin and multiple bundles that surround the cavities of the skeleton of the face. Agenda on the skin, they determine a series of local modifications on which the expressivity of the vault depends. This, in fact, changes according to the contraction and tone of the musculature, revealing in a plastic way the most subtle psychic reactions in all their variants. For this reason these muscles are also called mimics. It should be clear that, although some of these muscles favour specific facial expressions, it must be borne in mind that the contraction of each of them, if it is not coordinated with that of the contiguous muscles, is not enough on its own to produce the multiple and differentiated voluntary and instinctive expressions that distinguish feelings and emotions. However, although some fundamental mechanisms can be explained by the coordinated action of single muscle groups, most of the facial mimic expressions are not demonstrable only with any mechanical analysis, such as the different ways of expressing pain or surprise. However, we will try to give some indications referring to the possible expressions of the vault specific to the various muscles. In this regard, we recall the general concept according to which facial wrinkles are formed perpendicularly or almost perpendicularly to the path of action of the muscle that causes them.

The skin muscles can be divided into the following groups: muscles of the cranial vault, muscles of the eyelids, muscles of the nasa,

muscles of the mouth, muscles of the ear.

THE MUSCLES OF THE CRANIAL VAULT

Epicranial

The cranial vault is covered by the thin epicranial muscle or the scalp; these are divisible into two portions which correspond to the regions of the crania which it covers. They are the occipitofrontal (1) and the temporoparietal.

The occipitofrontal covers the anterior superior and posterior portion of the cranial vault. It is composed largely of a tendon area, called the aponeurotic galea, which is located on the median portion of the muscle. This has the particularity of being intimately welded to the skin and moving by sliding on the thin layer of the periosteum, below it, which covers the skeletal part. Consequently, the galea in motion drags the scalp with it.

Anteriorly and posteriorly it welds to two muscle portions called frontal and occipital respectively. It follows that the occipitofrontal is analysable and distinguishable in three distinct portions listed below.

Occipitofrontal, frontal portion (plate I, fig. A 1a.)

It is composed of two distinct quadrilateral muscle bands, flat and thin. They are united in their midline, near their origin (in the supraorbital margin), but progressively diverge in correspondence with the central part of the frontal bones which they cover, while remaining linked together by a subtle expansion of aponeurosis coming from the galea.

Origin: supraorbital margin.

Insertion: front edge of the galea (fig. A a.).

Occipitofrontal, intermediate portion (fig. A 1b.)

It is similar to the aponeurotic galley which is a sturdy mobile tendon membrane, which envelops the vault in the upper region and in the lateral region.

Occipitofrontal, occipital portion (see lesson 51, fig. A 1c.)

It is in turn composed of two distinct and quadrilateral bundles, but less extensive than the previous ones.

Origin: from the upper nuchal line of the occipital to the bases of the mastoid processes.

Insertion: rear margin of the galley.

Overall function of the muscles of the cranial vault: the front portion, by contracting, moves the superciliary region upwards; thus taking a fixed point on the galley, in turn held in traction by the occipital portion, it causes arcuate and convex transverse folds on the forehead and parallel to the eyebrow reliefs, generally manifesting in the vault an expression of attention and, in case of a greater contraction, of wonder or fear. If the frontal fibres get fixed point on the eyebrow, they cause the aponeurosis to slide forward on the forehead, so that the scalp is pulled forward. An alternating movement of the skin is thus possible, due to the greater or lesser contraction of the frontal or occipital muscle portions.

Temporoparietal: It is a little evident lamina between the frontal portion and the ear region.

THE MUSCLES OF THE EYELIDS

They are the orbicular of the eye (2) and the corrugator of the eyebrow (3).

Orbicular of the eye

It is a thin and flattened muscle that constitutes the eyelid rim (with this term we mean the linear slit created by the two adjacent parts of the muscle). It is composed of two parts called

respectively orbital and eyelid portion. These create the muscular wall which is modelled on the orbital opening and on the eyeball.

Orbicular, orbital portion (fig. A 2a)

It is elliptical in shape and with its fibres completely surrounds the orbital opening.

Origin: the fibres originate in the medial angle of the orbit on two points (fig. B 2nd origin) distinct from a central tendon interval called medial palpebral ligament (fig. A 1.p.); the upper portion originates from the nasal portion of the frontal bone, while the lower portion originates from the frontal portion of the maxillary bone.

Insertion: upper fibres attach to occipitofrontal and eyebrow corrugator fibres; a part of these, the most superficial, are also inserted into the skin of the eyebrow and in their contraction they bring it down, forming the small muscle called eyebrow depressor.

Orbicular, eyelid portion (fig. A2b.)

And the central and thinner portion of the orbicular, also elliptical, jumps to the skin of the eyelid. Its upper and lower fibres run over the eye and it is active in the blinking movement eyelashes.

Origin: from the medial eyelid ligament (fig. A 1.p.) interposed between the origins of the orbital portion.

Insertion: the upper and lower bundles converge laterally, intertwining in a lateral palpebral raphe texture (fig. A r.p.). The palpebral portion also has a small part of deep bundles, called the lacrimal portion, paste medially and close to the lacrimal sacs.

Overall function: if fully contracted, the orbicular muscle of the eye closes and medially moves the eyelids; at the same time there is a medial stretching of the skin of the forehead, temple and cheek towards the orbit. The skin therefore forms folds that branch off from the lateral corner of the eyelids themselves. The protrusion of the eyebrows, due to the forward movement, is determined by the narrowing of the eyelid rim. Its superior orbital bundles, which constitute the depressor of the eyebrow, are the cause of the formation of vertical skin folds located at the upper end of the root of the nose.

Eyebrow corrugator (fig. A3)

It is a small pyramidal-shaped muscle paste in a deep area with respect to the occipitofrontal and orbicular fibres of the eye. Create the medial relief of the eyebrow.

Origin (fig. B 3): from the frontal bone in its medial supraorbital portion.

Insertion: in the medial end of the skin of the eyebrow.

Function: stretches the eyebrow medially and downwards, thus bringing the two eyebrows closer together. In this way it strengthens the action of the upper orbital bundles of the eyelid portion.

MUSCLES OF THE NOSE

The procerus (4) and nasal (5)

Procero (fig. A4)

It is a pyramidal muscle and is placed in the area of the root of the nose, in close interrelation with the medial margin of the frontal portion of the occipitofrontal. It can be considered almost an extension of it.

Origin (fig. B4): from the tendon fascia that covers the lower portion of the nasal bones and, in part, from the lateral nasal cartilage.

Insertion: in the skin Ira the two eyebrows.

Function: Moves the medial corner of the eyebrow down. In the contraction it causes transverse wrinkles at the root of the nose. Together with the corrugator it intervenes in the movement of frowning.

Nasal (5)

It is a flat, triangular muscle located on the lateral face of the nose. It is divided into two parts: the transverse, also called the constrictor of the nose, and the alar or dilator of the nose.

Nasal, transverse part (fig. A 5a)

And the most expanded muscle part. Its fibres from the origin expand like a fan and end on the back of the nose, where they connect to a tendon lamina which in turn communicates with the other transverse portion specular to it.

Origin: from the maxillary bones laterally to the piriform opening.

Insertion: Dorsal aponeurosis of the nose.

Nasal, wing part (see lesson 51, table I, fig. A 5b)

Origin: just below the transverse part and, again with a small triangular band, it is inserted into the cartilage of the wing of the nose.

Overall function of the muscles of the nose: the transverse part, by contracting, constricts the nasal cavity, hence the name, and allows the movement to curl the nose, thus generating transverse folds; the wing part carries the wing of the nose backwards and laterally: consequently it dilates the nostril, especially in deep inspiration. And therefore antagonist of the transverse part.

TAV. I

Fig. A

Anterior view of the muscular system of the head.

1. occipitofrontal:
 - a. front portion
 - b. middle portion (aponeurotic galley)
- a. aponeurosis
2. Orbicular of the eye:
 - a. orbital portion
 - b. eyelid portion
- l.p. medial eyelid ligament
- r.p. lateral palpebral raphe
3. Eyebrow corrugator
4. procero
5. nasal:
 - a. transverse part
 - b. wing part

Fig. B

Frontal view: origin and insertion of the muscular apparatus of the head.

- 1a. front portion
- 1b. intermediate portion
- 2a. orbital portion
- 2b. eyelid portion
- 3. Eyebrow corrugator
- 4. pro wax
- 5. nasal:
 - a. transverse part
- 6. orbicular of the mouth
- 7. buccinator
- 8. Common elevation of the upper lip and the wing of the nose
- 9. proper elevator of the upper lip
- 10. small zygomatic
- 11. large zygomatic
- 12. canine
- 13. risorio
- 14. triangular
- 15. lower lip depressor
- 16. mental

Fig. C.

Anterolateral view of the osteocartilaginous structure of the skeleton of the nose

- l. lacrimal bones
 - m. maxillary bones
 - n. nasal bones
 - c.s. septal cartilage: (it is located on the median line and is in continuity with the lamina of the ethmoid and with the vomer).
 - c.l. lateral cartilage: (they are two triangular laminae joined to the cartilage of the septum and form the back of the nose).
 - c.a. nose wing cartilage:
(they are two small laminae curved on themselves that surround the nostrils).
-

Lesson 51

SKIN MUSCLES OF THE HEAD: MOUTH, EAR AND MASTICATORS

MOUTH MUSCLES

They make up a complex system that coordinates the movement of the lips; to understand their high specialisation, let us think not only of their expressive role but also and above all of the fundamental one of articulating sounds and contributing to chewing.

Taken as a whole, this apparatus is composed of an elliptical muscle part, the orbicular muscle of the mouth, which surrounds the buccal orifice and intrinsically constitutes the labial part. On this is grafted a series of small muscles that originate from the adjacent skeletal surfaces maxillary, zygomatic and mandible and which, grafting on the orbicular, act on the opening and closing movements of the lips. The muscles in question are: the orbicularis of the mouth (6), the buccinator (7), the common elevator of the upper lip and the wing of the nasa (8), the elevator proper of the upper lip (9), the small zygomatic (10), large zygomatic (11), canine (12), risorium (13), triangular (14), lower lip depressor (15), mental (16) and platysma.

Orbicular of the mouth (Plate I, figs. A-B-C 6)

It elliptically surrounds the mouth opening and forms the intrinsic structure of the lips. Being composed of a stratification of fibres, it can be divided into two parts, an internal labial, made up of deep fibres and which also partly belong to the contiguous muscle, the buccinator, and an external marginal part, made up in turn, largely part, from the fibres that come from the zygomatic, canine and triangular muscles.

Function: The labial part narrows and closes the vestibule of the mouth in order to fold the lips inwards close to the teeth, at the same time decreasing their thickness; The marginal part, on the other hand, moves the lips forward (protrusion), increasing their volume, so that the orifice of the mouth is configured in a rounded shape.

Buccinator (fig. A7)

It is quadrilateral in shape and flattened and occupies the deep region of the cheek.

Origin (fig. B7): it arises from the lateral face of the alveolar processes of the teeth I, II, III molars from both the maxilla and the mandible and partly from the pterygoid process of the sphenoid.

Insertion: the muscle fibres of the buccinator converge at the corner of the mouth and continue merging with the fibres of the orbicular with the following peculiarity: the upper fibres of the buccinator connect to the lower fibres of the orbicularis, while the lower fibres of the buccinator bind themselves to the upper ones of the orbicular, there was thus a tramway of crossed fibres at the corner of the mouth (fig. C7).

Function: move sideways and backwards! 'Angle of the mouth; it acts in blowing, compressing the air contained in the oral cavity; it also acts in chewing, as well as in laughter and crying.

Common elevator of the upper lip and the wing of the nose (fig. A8)

It is a small muscle composed of two distinct muscle bundles, the medial and the lateral, which have a common origin.

Origin (fig. B8): from the superior portion of the frontal process of the maxillary bone, at the medial angle of the margin of the orbital cavity.

Insertion: the medial fascia (fig. A8a) is inserted into the cartilage of the nasa wing; the lateral fascia (fig. A8b) leads to the upper lateral fibres of the lip, thus merging with the orbicular fibres and also with those of the elevator proper of the lip (fig. C8b).

Function: the medial head raises the wing of the nose and widens the nostrils; the lateral head raises the upper lip. Its contraction causes a subcutaneous fold along the lateral margin of the nasal muscle, giving the vault that expression generally understood as an indication of discontent or contempt.

Own upper lip elevator (fig. A9)

Origin (fig. B9): from the lower edge of the orbital cavity.

Insertion: leads to the lateral fibres of the lip, merging with the common elevator fibres (Fig. C9).

Function: and synergistic to that of the common elevator.

Small zygomaticus (fig. A10)

Origin (fig. B10): from a small paste area on the zygomatic bone, just lateral to the maxillozygomatic suture.

Insertion: leads to the skin of the upper lip (fig. C10).

Function: raises the upper lip of the mouth highlighting the teeth of the maxillary arch; it also cooperates in excavating and detecting the nasolabial fold; in expressions of complacency or indignation, it squeezes the upper lip and simultaneously acts on the elevator muscles to activate the smile.

Great zygomaticus (fig. A11)

It is a long, narrow, flattened muscle. Some of its fibres are mixed with both the skin and the orbicular of the mouth.

Origin (fig. B11): lateral face of the zygomatic bone.

Insertion: leads to the corner of the mouth (fig. C11), where its fibres blend with those of the canine and triangular muscles and also with those of the buccinator and orbicularis. In this intertwining fusion of fibres a small mass is thus created, a compact fibromuscular nodule called modiolus (fig. C m.).

Function: stretches the corner of the mouth upwards and backwards, thus affecting the nasolabial fold which from rectilinear which is in a normal state of the vault, draws a more convex curvature in the lower part, thus producing in the mimic a an expression of joy.

Canine (fig. A12)

Origin (fig. B12): canine fossa paste inferior to the infraorbital hole.

Insertion: the fibres lead to the corner of the mouth, where they dissolve in the modiolus (fig. C12).

Function: medially raises the corner of the mouth; collaborates in highlighting the nasolabial groove.

TAV. I

Fig. A

Lateral view of the muscular system of the head

1. occipito-frontal:
 - a. front portion
 - b. intermediate portion
 - c. occipital portion
2. Orbicular of the eye:
 - a. orbital portion
 - b. eyelid portion
3. Eyebrow corrugator
4. procero
5. nasal:
 - a. transverse part
 - b. wing part
6. orbicular of the mouth
7. buccinator
8. Common elevator of the upper lip and wing of the nose:
 - a. medial fascia
 - b. side band
9. proper elevator of the upper lip
10. small zygomatic
11. large zygomatic
12. canine
13. risorio
14. triangular
15. depressor of the lower lip
16. mental

17. masseter:

a. superficial part

b. deep part

18. temporal (in the deep plane)

Fig. B

Lateral view of the traces of origin and insertion of the head muscles.

Fig. C.

The muscular apparatus of the mouth.

m. modiolus

Fig D.

The pavilion of the ear - proportions and structure.

Risorio (fig. A13)

It occupies the lateral region of the lips. It is thin and triangular and flattened in shape.

Origin (figs. A-B 13): from the lining band of the masseter muscle, called parotid-masseterina.

Insertion: in the skin of the corner of the mouth.

Function: when it contracts it produces forced laughter, stretching the corner of the mouth laterally. Together with the large zygomaticus it determines the nasolabial folds

Triangular (fig. A 14)

It occupies the deep region of the corner of the mouth; and triangular in shape with the apex pointing upwards.

Origin (fig. B14): lower margin of the mandible.

Insertion: moving upwards, its fibres flow to the skin; others, on the other hand, at the level of the modiolus, radiate into the upper lip, contributing to the formation of the orbicular of the mouth and

in part also of the risorium; still others continue merging with those of the canine (fig. C 14).

Function: with open mouth tends downwards and sideways the angle of the mouth together with the modiolus. It highlights, bringing it to greater depth and on a horizontal trajectory, the chin-labial sulcus, thus determining an expression of sadness which, taken to the extreme, becomes one of disgust.

Lower lip depressor (fig. A15)

It is quadrangular in shape, also called square of the lower lip.

Origin (fig. B 15): from the oblique line of the mandible, from the symphysis of the mandible and the mental foramen.

Insertion: to the skin of the lower lip, partly intertwining with the square of the opposite side and with the fibres of the orbicularis (fig. C 15).

Function: brings the lower lip to the outside and to the bottom. If the two opposite portions cooperate synergistically, a forward roll-over of the lower lip is created, causing a deep and transversal depression on the skin that normally characterises the expression of disgust.

Mental (fig. A16)

It is a small cone-shaped muscle placed below the depressor muscle.

Origin (fig. B16): from the lateral incisor fossa of the mandible.

Insertion: lower extremity of the skin of the chin (fig. C16). When joined, its fibres form the convex and circular shape of chin. When they are slightly separated from each other, a characteristic dimple is determined on the median part of the chin.

Function: stretches the skin of the chin on which it determines the appearance of folds and the chin-labial groove. It helps the base of the lower lip in protruding action, such as speaking or when expressing doubt or uncertainty.

Platysma (see also lesson 42)

It is the most superficial muscle of the face, but it also radiates into

the skin region of the mentum. It is a thin lamina without any bone insertion and spreads under the skin.

Origin: it arises from the glabella, from the collarbones and, in part, from the chest.

Insertion: reaches the facial region and joins the risorius muscle and the lower lip depressor and also the triangularis.

Function: if it takes a fixed point downwards, it tenses the skin of the mentum and lower lip downwards; if instead it takes a fixed point at the top, it raises the skin of the glabella, which consequently forms oblique wrinkles.

MUSCLES OF THE EAR

The consistent flexibility of the pinna of the ear is determined by its fibro-cartilage structure called auricular fibrocartilage. The inner face of the pinna of the ear (fig. D) is concave and has slightly hinted skin reliefs and depressions corresponding to those of the outer face. The latter in fact presents multiple reliefs and depressions called basin, tragus, antitragus, helix, helix shower, antihelix, lobule.

The pinna of the ear is surrounded by three skin muscles: upper auricular, anterior auricular and posterior auricular. They move the pinna of the ear slightly in an anterior superior and posterior direction respectively to their position. All three surround the pinna of the ear and overlap the temporal fascia.

Upper earpiece

Raise the pinna of the ear upwards.

Front headset

Bring the pinna of the ear forward.

Rear earphone

Bring the pinna of the ear back.

Since these muscles are underdeveloped in humans and do not cause major skin changes, they will not be analysed graphically.

THE CHEWING MUSCLES

They are four muscles that derives the name from their geographical and functional arrangement: masseter (17), temporal (18), external pterygoid, internal pterygoid.

Masseter (fig. A17)

It is a thick, rectangular shaped muscle. It occupies the lateral face of the zygomatic arch, surmounting the branch as well as the angle of the mandible. Its fibres overlap and cross, arranging themselves on two layers, one superficial and one deep.

Masseter, superficial part (figs. A-B 17a)

Origin: by a robust aponeurosis from the maxillary process of the zygomatic bone and from the lower edge of the zygomatic arch.

Insertion: angle and median inferior part of the lateral aspect of the mandible branch.

Masseter, deep part (figs. A-B 17b)

Origin: internal surface of the zygomatic arch.

Insertion: in the superior part of the ramus of the mandible, as well as in the coronoid process.

Function: strongly closes the mouth and brings the jaw upwards, putting the two dental arches in contact with each other. In the contraction the lower part increases in volume and protrusion.

Temporal (fig. A18)

It has a fan shape and its fibres, going downwards, converge in a tendon that passes inside the zygomatic arch and leads to the coronoid process of the mandible. The temporal is enveloped by a fibrous membrane delta temporal fascia, which originates from the superior temporal line and leads to the zygomatic arch.

Origin (fig. B18): from the temporal fossa and the temporal line of

the parietal bone.

Insertion: Coronoid process of the mandible.

Function: raises and brings back the mandible a little, similar to the masseter; in contracting its bundles, the skin of the lateral temporal region (temples), produces a series of rhythmic contractions.

External and internal pterygoids

As they are both hidden by the branches of the mandible, they are not analysed graphically. Nevertheless, it is good to point out that the former cooperates and guides the articular movements of the jaw; the second raises the mandible by moving it forward.

Lesson 52

THE SYMMETRICAL AND ASYMMETRIC STATION

THE THREE-DIMENSIONAL RECONSTRUCTION IN THE BALANCE OF THE ERECTED STATION

In this last lesson dedicated to the reconstruction of the overall shape of the man-structure in the upright position, we will observe the latter in the two conditions of symmetrical and asymmetrical equilibria.

This lesson in particular allows us, on the one hand, to use all the analyses on the various elements of the human structure conducted up to now and, on the other, to recompose them in the primary condition of equilibrium of the human body: the symmetrical upright position.

First of all, we will have to reconnect to the first three lessons in which the basic coordinates were stated to start the investigation on the form, where the modular-proportional indications and the key points of the standing position (see lessons 1-2). On that occasion we proposed a modular subdivision into eight heads as a proportional element for the condition of measurement that accompanied us as a dimensional subtext in all the lessons and which now, finally, becomes a place for a unitary rereading of the form.

This is reconstructed here according to a three-dimensional reading that starts from the identification of the main reference planes - frontal and sagittal plane - (table I, fig. A and see lesson 1) and then represents them in a visualisation that uses the perspective artifice as method of rereading ordered the whole. On this scaffolding the individual skeletal and myological volumes are reinterpreted, structural and plastic entities of the form, always perceived as a whole through a succession of transparent stratifications.

From figure A we pass in sequence to figures B, C and D, where the

perspective grid shows us the basic shapes of the main volumes of the skeleton and their relationship with the p axis. in the symmetrical standing position. This relationship is given by the following points: the centre of gravity of the head (fig. D1) where the lead originates which then meets, in order, the centre of the upper orifice of the thoracic cage (fig. D2), the first lumbar vertebra (fig. . D3) and the promontory of the sacrum (fig. D4) and which is brought between the two knees anterior to the trochlea of the femur (fig. D5), and then falls into the base of the feet (fig. D6; see also lessons 1 and 2).

We then see the drawing of fig. And, where the skeleton is reconstructed and from this we obtain the salient points of a system of volumetric tracings which are the point of mediation between the skeleton and the muscular forms (table II, figs. A-B-C). In table III and in N we can instead notice a reconstruction of the muscular forms that highlights the plastid volumes of the whole, while always maintaining a transparent ability to relate them to the skeletal structure.

Before moving on to asymmetrical equilibria, one last reflection. The meaning of these pages is at the same time final because they rearrange the structural elements, but also at the beginning because they give tools to move to a more free and interpretative workflow, which - precisely because individual and subjective - could not have been the purpose of this text. . From this point on, the path traced by this manual leads to a sort of paradox: the structure must be denied to leave room for its memory. And in this form-conscious memory the sign will have to find its own individuality.

TAV. I

Fig A.

Front and side view of the man in the modular division into eight heads.

p. plumb (vertical) or balance axis

T. head module

F. modular ratio corresponding to the face

Fig. B

Antero-lateral perspective view of the main construction planes of the form: sagittal and frontal planes

Fig. C.

Interposition on the axis of the constructive skeletal perimeters of the form.

Fig D.

From the perimeters to the three-dimensional and exploded shapes of the rib cage and pelvis.

1. head
2. upper rib cage orifice center
3. The lumbar vertebrae
4. promontory of the sacra
5. median tip of the knee
6. median tip of the toes

Fig.E

The skeleton

TAV. II

Fig. A

Structural and volumetric perimeters

Fig. B

Structural volume and plastic form.

Fig. C.

Internal-external of the human form. Relation between skeletal perimeter and muscle volume.

TAV. III

Fig. A
the myological system.

Fig. B
Study on the movement of the upper limb in relation to the shape of the square (see also lesson 2).

TAV. IV

Fig. A-B-C
Examples of reconstruction of the form with a posterolateral viewpoint.

THE ASYMMETRIC BALANCE

After probing the standing position in the condition of symmetrical equilibria, we now see how it is equally possible through the condition of asymmetrical equilibria, also called opposed.

By asymmetrical upright posture we mean that condition of equilibrium of the body when it rests on only one limb. To understand this, let us examine the substantial differences between the two conditions of equilibria. In the symmetrical upright position, the balance or lead axis (pl. I, fig. B p.) Divides the figure into two mirror halves and from the centre of the head falls into the base of the feet. In the case of asymmetrical equilibria, we have a lateral displacement of the body and of the relative axis of equilibria, so that the limb that supports the body moves in a conspicuously oblique trend with the foot on the axis (fig. B p1). Given this oblique direction of the lower limb (fig. B1), the segment of the pelvis tilts laterally (fig. B2) until its median line coincides with the p1 axis. Consequently, the thorax (fig. B3) and head (fig. B4) tilt, opposing each other until the head is brought back into a barycentric relationship on axis p 1, thus rebalancing the body. We also note that, due to the various inclinations, the body in the

asymmetrical posture is slightly lower than in the symmetrical upright position.

Let us now observe in more detail the behaviour of the skeletal structure in relation to the equilibrium axis. Assuming that the weight of the body is supported by the right foot (fig. C1), which ideally meets the axis in the centre between the tarsus and metatarsus, the leg segment bends and brings the knee laterally to the axis; this displacement affects the position of the femur and involves a slight lowering of the pelvis (fig. C3) which tilts on the left side so that the promontory of the sacra (fig. C4) finds its coincidence with the axis.

This is how the principle of the opposite is imposed on the inclination of the pelvis, given that an excessive imbalance of the weight of the body to the left leads to a change of direction in the vertebral column which, curving in the lumbar region (fig. D5), brings back the centre of gravity of the thorax, ie the centre of the upper orifice (fig. D6), in line with the axis.

As a last phase of compensation, the cervical tract, bending to the left, brings the head back into axis (fig. E7).

TAV. I

Fig. A

A. Dürer, male figure in opposing equilibrium.

Fig. B

Symmetrical and asymmetrical balance.

p. symmetrical balance axis

p.l. asymmetrical balance axis

1. schematic perimeter of the lower limb segment
2. schematic perimeter of the hips and abdomen
3. schematic perimeter of the chest and shoulders
4. schematic perimeter of the head

Fig. C.

Behaviour of the right lower limb and pelvis in asymmetrical balance.

p.l. balance axis

1. foot
2. knee
3. pelvis
4. promontory of the sacra

Fig D.

Behaviour of the spine and trunk.

5. lumbar spine

6. center orifice upper rib cage

Fig.E

Behaviour of the head.

7. centre of gravity of the head

Fig. F

Global observation of the asymmetrical balance of the skeleton and the plastic relief of the muscles.

TAV. II

Figs. A-B-C

Anterolateral view. Example of the opposite arrangement of the volumes in the nude.

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